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THE PSYCHOLOGY OF TICKLING, LAUGHING, AND THE COMIC.

BY G. STANLEY HALL AND ARTHUR ALLIN.

In February, 1896, the authors of this paper issued a syllabus (No. 10 in the series for that year), entitled, Tickling, Fun, Wit, Humor, Laughing. This was widely circulated, and brought returns up to the date of writing from, in all, about 700 persons, reporting sometimes on themselves and often collectively from many others, so that nearly 3,000 people and perhaps 4,000 items are represented in the following report. The method of gathering and collating these data was very similar to that described in a report on fears.¹ All received up to July, 1896, were carefully and fully analyzed by one of us (A. A.), who collected most of the literary references, drew a number of the most important conclusions, and turned over a preliminary paper to the other author (G. S. H.), who here undertakes to incorporate other returns, add other conclusions, rewrite and give final shape to the article. As for so many other of our syllabi, many of the best returns have been obtained by Miss Lillie A. Williams of the Trenton, N. J., Normal School. The questionnaire is as follows:

1. Just how would you tickle a child, physically, *i. e.*, a baby, as touching its cheeks, chin chopping, etc.; a child from three to six, as by animal noises, actions; a child at adolescence? Enumerate all the ways of tickling by physical contact or by actions and noises without words. Which would be surest to cause laughter, making faces? Are you, or are children, more ticklish at some

¹ AMERICAN JOURNAL OF PSYCHOLOGY, Vol. VIII, No. 2.

times than at others? What parts of your body are most ticklish, and at what motions, pointings, etc.?

2. Describe individual cases of giggling, simpering, smiling, tittering, grinning, convulsive and hysterical laughter. Describe individual peculiarities, as in smiling, one-sidedness, or simpering, excessive display of teeth, open or shut mouth, position of head and eyes, and attitude or vocal aspect of a laugh. What kind of noises do different people make in laughing? As the laugh spreads over the face, what features are first and what last involved? The same of the body to the point of falling down in convulsive laughter. Describe feelings, symptoms and after-effects upon self or others. Did you ever hear of one dying of laughter, or can you refer to any literary descriptions of laughter? Can and should we try to train ourselves or children to make prettier faces and noises when they laugh, or leave all to nature? Do they clap their hands and jump for joy? Do they laugh at smells and tastes?

3. Recall a few cases of great laughter in children and describe its cause, stories, jokes, funny mishaps, buffooneries, mimicry. What traits and acts do children laugh at in others? Give as good a list of school-room comicalities, as caricature on slates and blackboard, things pinned on garments, acts, habits, garments, etc., thought "perfectly ridiculous." What pictures in a magic lantern show excite most merriment among children? What parts of what pieces read? What have children found very droll, to your surprise, or that did not seem funny to you, and conversely, what do children do that makes you laugh without their intending it? List as many correct instances here as you can, always stating age and sex. Have you noticed any difference between children and adults or between older and younger children in this respect?

4. What have you ever seen or heard of that seemed as if any animals laughed? Have you seen them grin when you thought it was a laugh? Does a dog smile with its tail? Do hens, geese, horses, monkeys, calves make any noise that can be interpreted as a laugh? e. g., when frisking or gamboling in the pasture for the first time in the spring. Describe also their antics and contortions which seem pure play and fun for them. Do birds cluck or make other noise from pure joy? What do you think about the whole matter of animal fun, humor, laughter, wit, jokes?

5. Recall a few cases where you have laughed hardest and tell what caused it; also a few cases of unusually hearty laughter in others, and in audiences in theatres, and minstrel shows. Is there anything you can never recall without laughing? Also the most comic thing you ever heard of.

6. Kindly consider carefully and write the best you ever heard of each of the following: (a) pun, (b) repartee, (c) practical joke, as hazing, imitations, or horse play of any sort, (d) the funniest dinner or club story, or social anecdote, (e) the drollest, quickest, oddest story, (f) describe the funniest character you ever saw or ever read of.

7. What do you like best or dislike most in: (a) burlesque, (b) caricatures, (d) satire, (e) droll or silly "carryings on," (f) quaint or humorous, naïve, eccentric traits, etc., and whether in persons, or literature or on the stage? Which of these do you like best and least, and why? Describe your feelings at futile efforts to be funny or to make you laugh. Is it true that satire and wit are declining and a sense of humor increasing?

8. Describe any case of purely spontaneous laughing, in self or others, when simple self-complacency or a merry disposition, or joy at living was the only cause. What is banter or the milder

pleasantries of mind? Wherein does the wit (if any) consist in banter, derision, mockery, ridicule, rallying?

9. What peculiarities have you noticed in the wit and humor or stories or laughter of old people? Describe carefully any similarity you may notice between youth and old age in the matter of wit and humor.

10. Describe cases of laughter and joy at calamity of others; children laughing at ugly or deformed people. Is mirth growing more or less bitter?

11. Miscellaneous. Have you anything, or do you know of any helpful literature on this subject? Why do the insane laugh? Traits of wit and humor among different nationalities? Pleasure in painful acts, as picking sores, and probable cause of it?

I. *Physical Act of Laughing.* This has been described in great detail in our returns. Of few acts in childhood are mothers better observers than of the way in which their children laugh, how each feature is affected, and in what order. Returns upon this theme are far richer in detail than those upon crying, because the latter distracts the attention to the cause and its possible removal. Very striking is the immense individual variation in intensity, point of onset, expression of each feature, gesture, reaction, noises made, etc.

Many describe the *preliminary subjective symptoms* of a laugh commonly in such phrases as "I felt bubbling over," "ticklish sensation in stomach," "swelled up," "must laugh or burst," "immense strain to hold in," "funny feeling coming up from the stomach," "a store of energy I must expend," "I must laugh, I'm compelled, forced to do it to relieve a strain," "a creepy feeling inside spreading over the whole body," "am excited and know something must happen," "feel full of something to the point of bursting," "miserable if no outlet," "a quiver, thrill, or creepy feeling passing up from the stomach to the mouth," "eyes and cheeks protrude and can contain myself no longer, but feel empty later," "feel strong before, weak afterward."

The beginning and progress of the laugh are described in a large body of returns as observed both in others and in self. Typical cases are as follows: *Male*, 16. Lips first curl, then eyes shine, face changes and grows very handsome, then body sways, head is thrown back, mouth is wide open, rocks and emits ha, ha, for several minutes, till he is fatigued and slowly sobered up with a deep sigh. *Female*, 19. First squints her eyes until they are almost closed, then draws up the corners of her mouth in a twitching, shows a large surface of teeth and gums, then opens mouth, muscles of the neck jerk, head falls forward, shoulders shake, she doubles up convulsively, sometimes falls on the floor and ends with sobs and crying. *F.*, 11. Begins to laugh with twitching of the nos-

trils, then of the corners of the mouth, eyes open wide, mouth shut, and cachinnates through the nose, recks from side to side, clasps her hands together, often drops on floor, gets red in the face, shrieks and shows hysterical symptoms. F., 19. Ears move first and mouth last, eyes glisten, shoulders shake, head is thrown back, body forward, and the movement of the diaphragm is excessive, and often becomes uncontrollable. F., 16. Begins by opening mouth and eyes wide, head is tossed back and to the right, cheeks dimple, shoulders shake, and the noise is very soft. M., 30. First sign is rapid winking, teeth are shut tight, lips drawn well away from them, shoulders shake, but there is no noise.

In our returns laughter began in 71 cases with the eyes, and in 51 cases with the mouth. The eyes are said to grow bright, glitter, sparkle (involving a tension of all the muscles of the bulbus), to twinkle (rapid lid movements), to dance (irregular or oscillatory movements of the recti), the mouth stretches, corners are drawn upward or sometimes downward, very often twitch or quiver. The mouth commonly opens, except in the simper, when it is nearly or quite closed. The lips are said to curl. In a few cases the laugh begins with dimples in the cheeks, and in others the muscles just below the ear move. In still other cases the first symptom is the throwing back of the head, and in others a snort or chuckle. Of the body movements about two-thirds assert that the shoulders, and one-third that the diaphragm, first move. As the cheeks are drawn upward and backward, the teeth show and the eyes grow small. In exceptional cases there is almost no feature, limb or movement that may not be the first symptom or aura of a laugh. It is sometimes the eyelid, sometimes the lower lip, upper lip, the toss of the head, tensing of the eye muscles, opening, or sometimes the closing of the teeth, swaying of the body, movement of the shoulders, hips, etc. Subjectively, too, the "funny feeling" may begin in the stomach, throat, head, diaphragm, face, etc. In some cases many of the noises and movements suggest crying, in others they suggest some kind of tic or convulsion. Often beauty is greatly increased or indeed evoked in faces that are ugly when sober, and ugliness that suggests defect or even deformity first appears in the laugh. The eyes are sometimes open, sometimes shut; they usually grow bright, but occasionally dull; both lids may tremble and the ball twitch as in nystagmus. They may grow rigidly fixed or roll wildly, may be turned upward and inward, and are often suffused with tears. The mouth, too, takes almost every variety of position, as does the head, and almost any sequence may be inverted.

In the height of the laugh in some cases the chin quivers ; the diaphragm movements are sometimes almost convulsive ; some plant the elbows on the knees ; others rock violently sideways, or more often back and forth ; the hands are thrown into the air or clapped on the thighs ; the face is distorted by various puckers, squints, wrinkles all over the forehead ; lacks in symmetry, especially if there is embarrassment ; the limbs jerk ; the foot is stamped ; the fists pound ; the face is sometimes distorted almost beyond recognition ; waves of nervous tremor pass over the body ; the face, neck and ears are red ; the veins distended ; the hand is placed over the eyes, mouth, or both ; cheeks puff ; some show every tooth, and one can see almost down the throat ; the saliva flows ; little children jump up and down, lie on the floor and roll all over the room ; some swing the hands in the air ; the breast heaves up and down ; some turn around on the heel from left to right, or *vice versa* ; the head shakes from side to side ; many find it almost impossible to stop ; about a dozen in our returns laugh with marked asymmetry ; some show excessive surface of gnmis ; others always hold the sides with both hands ; others roll the head ; features often twitch or tremble convulsively. Embarrassment and affectation very greatly modify both the gestures and the noises in laughing.

Each of the above expressions may be perverted or repressed to a strange grimace, simper, snicker or giggle. Some laugh mostly within, with very few of the above expressions, of which while none have all, most have some. Two of our returns, on the other hand, describe laughter so intense that death from ruptured blood vessels ensued. The degree of risibility is a very fluctuating quantity. Some young children are so ticklish that a pointed finger will convulse them ; others giggle at almost everything, and are victims of provocations to laugh that are sometimes incessant and almost cruel, yet other children are stolid and rarely laugh. Very diverse and interesting is again the difference in the tempo and rhythm of the laugh. Its onset may be very gradual or instantaneus and explosive, and the eachinations may be deep and strong, and the tones from the chest, or a shallow rapid titter. The individual fluctuations in all these respects, with mood, fatigue, etc., are considerable.

The vocal expressions of laughter are extremely diverse. The sound most generally emitted is described as he, he, passing over to ha, ha. But almost every kind of noise occurs. F., 17. Is said to "bray somewhat like a donkey." F., 15. "Cackles." M., 28. Makes a loud guttural

"yock." *M.*, 10. Laughs "somewhat like a rooster." *M.*, 21. "Snorts." *F.*, 15. "Grunts like a pig." *F.*, 20. Laughs without vocalization, but with a noise like the emission of steam. The laugh of Chinamen is described as a chattering sound. One laughs "deep down in his chest;" another "laughs up among his teeth;" another is said to have a laugh which is said to be like a "fog horn;" another "rumbles." *F.*, 17. "Yells and shrieks." *F.*, 10. Laughs with a "simmering laugh." *M.*, 16. With an "explosive staccato sound." Some make no noise at all, others sob or make a noise that seems like crying. Some are said to snarl, others make a very soft te-he, others a loud ho, ho, three are said to "neigh like a horse," some only gasp, some laugh in a very high, some in a low key, some make noises said to be indescribable or between a laugh and a cry. Every vowel and most consonants are used in our returns in efforts to describe noises. Some "laugh like parrots, crows, peacocks, sheep, goats;" some make a "scraping, rasping, throaty noise," and some a very musical tone; some go up and some go down the scale. Other laughs are described as "tse, tse; ule-ule; hep, hep; haw-haw; wah, wah; iff, iff; hickle, hickle; kee, kee; gah, gah." Some laughs are described as "trilling, rippling, quacking, chneckling." *F.*, 16. Begins ha-ha at upper do, and runs down the scale, then drops to first note and runs up again. *F.*, 15. Runs down the scale with a very musical ha, ha. One laughs up and then down the scale without any trace of mirth in her voice or face. Another draws her breath very hard through the nose, and her laugh is a "peculiar sniffle." It has been said that adult men more often laugh in o and a, while children and women laugh in e and i.¹ These latter vowels have naturally, as Helmholtz has shown, a higher pitch than the former.

The *after effects* of a hearty laugh are generally described as exhaustion, heavy breathing, fatigue, shame, weakness, depression, soberness, sadness, relief, weakness localized in various parts of the body, the deep sighs, giddiness, perspiration, headache, stitch in the side, soreness, thirst, sweating, chills, sleepiness, uncontrollable movements, nausea, tears, fear of impending disaster, breathlessness, etc. On the whole, then, the laugh is not unlike an epilepsy from the aura, at which stage it may be checked to the subsequent exhaustion.

Opposite as are our states of pleasure and pain, their expression is not so dissimilar but that in some cases of immaturity, hysteria or extreme provocation, they are confused.

¹ "Gratiolet, *D' la Physionomie*," 1865, p. 115.

Cases of each of these are such as the following: A company of young people, of both sexes, from 19 to 24, were sitting together when the death of an acquaintance was announced. They looked at each other for a second and then all began to laugh, and it was some time before they could become serious.

F., 20. Must always laugh when she hears of a death, and has had to leave the church at a funeral because she must giggle. F., 18. On hearing of the death of a former schoolmate felt very sorry, but could not control her feelings, and laughed as heartily as she had ever done in her life. Despite her effort to be serious she had to break out into a laugh repeatedly. F., 19. Often laughs when she hears people speak of the death of their friends, not because it is funny or pleases her, but because she cannot help it. A frontiersman, in a well authenticated case, came home to find his dearly beloved wife and children all lying dead, scalped and mutilated by Indians. He burst out into a fit of laughter, exclaiming repeatedly, "It is the funniest thing I ever heard of," and laughed on convulsively and uncontrollably till he died from a ruptured blood vessel.

It has been shown by the very careful experiments of Brücke that when the head is thrown back, shoulders up and the body generally is bent backward, the blood tends to flow from the arteries, where pressure is high, into the veins, where pressure is low. If laughter is more often associated with the latter position, and crying with the former, this would go far to account for the subjective difference between the two, and would connect the relief of a laugh with the remission of arterial tension.

On the whole the phenomena of violent laughter seem, when looked at coldly, strange to the point of weirdness, and almost inhuman, although it is most conspicuously seen in man. Why do we gasp and emit animal noises, fall into partial cramps and spasms that may end in coughing, yawning, pain all over, general indifference and disgust at the very cause of our laugh? Why do we strive by holding the breath, biting the lips and other inhibitory efforts to check this diffusion of excitement, which makes the heart throb, the blood dance, gives a sensation of levitation and then passes on to a state almost of swoon and atavistic and perhaps pre-human convulsions? Is Vasey right¹ in his contention that man is not originally a laughing animal, that laughter is not universal among primitive people, that many ancient races

¹"The Philosophy of Laughing and Smiling," 2d ed., London, 1877, especially p. 194.

regarded it as undignified, and that a gentleman and lady should smile, but never laugh? Is hearty laughter invariably a type of vulgarity, shallowness and want of dignity? Should not only tickling and every appeal to the risibilities of children be banished? and indeed does a sad mood unfold a wider mental horizon than a joyous one? How far can we, or should we try to repress all unpleasant expressions and noises in children, and how far would our efforts to do so be likely to result in affectation worse than the disease? Forty-five say we should educate children to laugh aright, seventeen think we should not do so.

All these are questions which in this early stage of investigation into this vast and fascinating topic we must ask, but cannot yet answer.

It is noticeable that if we conceive laughter as one of Hughlings Jackson's "innumerable epilepsies," it is in the majority of adults, one of those which begins with the highest level in consciousness and with the finer muscles, and passes downward to lower levels and more fundamental and earlier developed musculature, although sometimes in children this order is exactly inverted. Expectation, perhaps all that is available, is strongly generated in the higher regions of consciousness; the resulting movements pass down the genitalic and perhaps meristic levels till circulatory, glandular and even intestinal and excretory activities are affected and the sphincters relaxed. The mental horizon of expectation was the largest, but this narrows down to the most intense focalization upon the mirth-provoking object till the soul is, as it were, impaled on the sharp point of the jest. The objective world has vanished and is forgotten, the proprieties and even the presence of others are lost, and the soul is all eye and ear to the one laughable object. Care, trouble, and even physical pain are forgotten, and the mind, as it were, falls back through unnumbered millennia and catches a glimpse of that primeval paradise where joy was intense and supreme, and where life and the joy of living were both inconceivably vivid and were expressed by the most generic, primeval and correspondingly energetic sounds and movements, from which all other and later human sounds and movements have sprung. Perhaps such condensed joy and such erethic manifestation of it lack economy in our world of indirect, reflected, derived and dimmed pleasures, and, perhaps, adults should not, as children may, go to heaven in a laugh. It is a fact of peculiar interest that many children in our returns laugh habitually at nothing, except the mere joy of being alive and the euphoria of their own spontaneous movements of mind and body. Just as there are psychalgic states in which every

activity is pain, so we must postulate hedonic states in which every activity gives pleasure. How and why this reacts into the sigh, the natural history of which Henle has discussed, and how the intermittent element is connected with the respiratory apparatus in the medulla, whether laughter intensifies expiratory and a sob inspiratory movements, our returns give no data to determine.

The data of our returns make it possible to treat these topics in a more concrete and objective way than has hitherto been possible. Most treatises on aesthetics have approached the subject from standpoints that were abstract and theoretical, if not indeed metaphysical. As in most fields of psychology we have drifted too far from the homely facts of common, every-day average human life, and have emphasized the exceptional and have wandered to many speculative fields. The above data seem to fall into a few natural groups, and suggest that the act of physical tickling is very basal for any proper treatment of this subject. The importance of animal acts and noises, the relations of laughter to fear and joy at calamity, are rubrics the importance of which both for science and education is not adequately recognized in the literature, while the new standpoints which seem so obvious and inevitable to the biological mode of thought have not yet been suggested. The present paper, although intimating these new points of view, is so inadequate to the vast and hitherto unsuspected complexity of the subject that it can hardly claim to be more than notes calling attention to the need of further detailed work.

II. *Tickling.* From the mass of returns the best upon this subject were selected, and show that children are most ticklish as follows: soles of the feet, 117; under the arms, 104; neck, 86; under the chin, 76; waist and ribs, 60; cheeks, 58; knee, 25; down the back, 19; behind the ears, 15; all over, 15; palms, 14; corners of mouth, 8; breast, 8; nose, 7; legs, 5; elbows, 3; lips, 3; etc.

Some of the above children mention several places, and so appear several times. "Tossing up is mentioned 11 times; blowing on the cheek, down the back, behind the ears, in the eyes, pinching toes, are each mentioned several times. The tickle zone is often spoken of by children as the funny place. Unexpectedness, a delicate instrument like a straw, feather, ravelings, rubbing, a cold draft on the spine, playing bite the finger, pointing toward and threatening to bore into the body, are all mentioned. Two small children are so ticklish they scream with laughter if touched. One child laughed in its sleep for ten minutes after being touched on the sole.

F., 17. If tickled under the arm slides to the floor and screams with laughter. If any one whispers in her ear she must laugh. If a friend blows upon her skin or makes a buzzing sound, she writhes and screams. F., 3½. Is stout, and shaking her always makes her laugh. F., 10. Feels ticklish and must laugh if swinging, even in a hammock. F., 17. Feels ticklish and must giggle in going down in an elevator. M., 20. Is very ticklish for every creepy, crawly motion if only just felt. M., 4. Can be tickled only by pointing at him.

A special supplementary question as to where children were most ticklish shows the following in order of frequency: soles of the feet, under the arm, neck and throat, ribs, back, under the chin, stomach, knees, at sight of pointed finger, cheeks, palm, upper lip, nose. Contact of the soles of the feet may cause almost agony. The word soles sometimes causes slight tickling. Sensitiveness to faint contact may vary with the state of feeling, *e. g.*: F., 20. Is always ticklish in the soles of her feet and in one or more other places, according to the state of fatigue, mood, etc. Many mention sensitiveness to contact or movement, perhaps, especially if zigzag, just heavy enough to be felt. A few seem almost equally ticklish in every part, and others solely in exceptional parts, like the palm of the hand. When near the ery point, some children, otherwise very ticklish, are like stone to every stimulus. Simply pointing the finger at many sensitive children, especially if it is rotated in a spiral motion, sometimes causes laughter so intense as to be almost hysterical. Some are ticklish only near bed-time, or when very tired.

Sixty clearly marked cases are more ticklish at one time than at another, as when they have been "carrying on" or are in a happy mood, are nervous or unwell, after a good meal, when being washed, when in perfect health, when with people they like, etc. Some are more susceptible through sight, others through hearing or touch, and some are specially sensitive in the sphere of smell, and some even of smell and taste. In 107 cases laughter or tickling results from merely seeing a finger pointed with movements suggesting tickling. Slow circular movements of the index finger, then stopping these and thrusting it toward some ticklish point, especially if with a buzzing sound, make many young children half-hysterical with laughter.

Many children in these and other returns form the habit of picking the skin. Not only scars, to which childish instinct seems to have a great aversion, but pimples and the slightest roughness often excite very strong desire to remove them. Often they have been observed to pick for hours continuously and physical restraints sometimes become neces-

sary. Occasionally larger scabs, due to wounds, are worked on with growing impetuosity until they are removed. Occasionally a child purposely cuts or abrades the skin on its hands, not to remove roughness, but apparently to create a scab. One grew fond of dropping the grease from a lighted candle on his hands for the sake of the pleasure of picking it off afterwards. Hang-nails, callous bits of skin or those loosened by blisters are often removed with great pain. Some children pull out the hairs from head, eyebrows, lashes, hands, and elsewhere despite the pain. Two games of rubbing the skin off of the back of the hands became fads; pins are thrust through the cuticle and the skin broken. Children dare each other to cut, bite, or otherwise get through the skin, not so much to see rawness and blood, which they abhor, or have sores dressed, as to gratify some deep impulse to fuss with the skin.

It is hard to explain such instincts, and indeed they are hard to analyze. A slight pruritus; automatic instincts on the motor side to pick, perhaps stimulated to far greater intensity by the pain itself; the impulse to remove roughness, perhaps a hunger for some specific dermal sensation in children slightly anaesthetic analogous to "light hunger of the eye;" a desire to gratify the exquisite tactile sensation of smoothness which in hand-shaking and the caresses of lovers is so important a factor,—all these may have been elements, and may have played an important rôle in natural selection and in the original depilation of the human body, the proper stroking of which is still a source of pleasure.

The strange sensitiveness to minimal tactile impressions all over the body has never been explained. Although Frey, Goldscheider, Nichols and others have sought to measure its intensity, no modification of this strange reversal of the psycho-physic law for that scale of stimuli which causes greater reactions, the slighter they are, has been given that is satisfactory or that has won general acceptance. Why is it that contact with the finest hair, wool, or cobweb evokes sensations that are not only exceedingly intense, but also very widely irradiated, and also provokes reflex movements that may be convulsive in their intensity, but when the same pressure, it may be of the same object and upon the same spot, is slightly increased, only the localized and moderate impression of touch is produced, with proper or no motor reactions? This paradoxical phenomenon is so unique and so distinct from that caused by stronger pressures on the ribs and elsewhere that it should no longer be included under the general term ticklishness, but should have a different name. Pending a better nomenclature we suggest for the former the

term knismesis and for the latter the term gergalesis, with the adjectives knismic and gergallic, hyperknismesis and hypergergalesis for excess, etc.

Primitive organisms had only the sense of touch. For them there was no sense of gradual approach, but danger was announced only by contact, and therefore came with great suddenness and caused strong reactions of escape or resistance. The gradual evolution of sight and perhaps smell and hearing as an "anticipatory touch," mitigated the primitive shock in which, perhaps, all psychic life originated, and enabled preparatory adjustments to be made. Growing psychic life distinguished between dangerous and harmless touches, but so inconceivably long was the ontogenetic period before these reductives became established that traces of the old psycho-neuroses are not effaced. Although we know little of their neural basis we can often catch glimpses of the adaptiveness of these primordial reactions. Again the very energy which minimal stimuli develop has no doubt now a prepotently trophic significance, and yet again their dynamogenic service for higher processes, even those which inhibit them, is no doubt great. Once more as the psychic field has enlarged and attention has acquired increasing power to abstract available energy from its negative field to focus it elsewhere, unusual sensations in rarely functioning parts revert, so that, especially in states of fatigue and in regions where inhibition is rarely needed, outcrops of the old tendencies are seen. Stronger touches evoke inhibition, long-circuit processes into the field of intelligence and will, which act by the very energy thus developed. These minimal touch excitations thus represent the very oldest stratum of psychic life in the soul, and have still in their strange sensitiveness and energy reminiscences of the primeval vigor and spontaneity of the dawn of psychic life, and especially of sight and hearing, in the world. Thus keenly did organisms feel the world about them, thus intensely did they react to it in that eocene age of the soul before the soma had been mechanized, and before its vitality had lapsed to a degree of vigor which separated it so far from that of the reproductive elements and established death so firmly in the world. It is thus with growing interest and awe that we contemplate these phenomena.

Homelier and more vulgar experiences must also be suggested. The insect world in all its immensity has always been a part of human environment, and has no doubt played an important rôle in the maintenance and development of this psychosis. Parasites of many known and perhaps more unknown species have always infested the skin, and a large volume of animal activities are still directed toward their re-

moval. Some are dangerous and must have evoked reactions of corresponding force like the almost spasmotic movements of the horse at the slightest touch of the bot fly, which sticks an egg on the tip end of the longest hair of its gambrels or fetlock. The fact that even a few are dangerous strengthens the movements against all, while the fact that their attacks are almost incessant establishes a stronger habit of reaetion than do the attacks of larger but more infrequent enemies, on a principle analogous to that which makes small but certain punishments more effective than severe but uncertain ones as deterrents of crime. Again, the slighter and less dangerous experiences less often kill, so that their effects accumulate.

Belt, in his "Naturalist in Nicaragua," suggests that man's hairless condition was perhaps brought about by natural selection in tropical regions, where he was greatly troubled with parasites. Hudson in his "Naturalist in La Plata," (p. 143) says it is almost necessary to transport oneself to the vast tick-infested wilderness of the new world to appreciate the full significance of Belt's suggestion. He affirms that it is quite certain that if in such a country as Brazil man possessed a hairy coat, affording cover to the tick and enabling it to get a footing on the body, his condition would be a very sad one. It is of course well known that savages abhor hairs on the body and even pluck them off their faces. The soft lanugo hairs with which man is still covered point back to the time when the whole body was covered with a disadvantageous coat of hair. There is certainly more than training and education in the instinctive furor and impetuosity noticeable in the habit of picking scabs and removing excrementitious matter and disadvantageous excrescences from the surface of the body.

Whispering in the ear may cause a recrudescence of the old sensitiveness out of which its functions were developed, and the more we understand and are impressed by the whispered words the more this hyperesthesia to the noise and breath stimuli decreases. The often excessive itching caused by very slight movements adds the sense of life to that of contact to the object which touches, while the noise of buzzing as a laughter excitant suggests its own explanation.

Very different is the lesson which is taught by the list of parts of the body which are most sensitive. Lowest in the scale are points like the shoulder-blades, shoulders, thighs, calves, etc., harder touch and even invasion of which are dangerous only in a low degree. The soles of the feet, throat, knees, palms, etc., are far more vulnerable, and contact with these carries with it a higher degree of what may be called

physical suggestiveness of danger. In the long struggle for existence wounds or thrusts here have caused more pain and inconvenience than in less vulnerable regions, or even than in those that were more so, because the latter have killed, while the former have been consistent with long survival and pain, with the possibility of recurrence. Pointing at these parts without touch, boring motions, gestures of biting, stabbing, or any other form of invasion, here evoke the gestures of danger and its excitability without any strong sense of it. These "clotted masses of motion" have their sensory analogue in the felted and macerated masses of sensation, caused by stimulating the soles of the feet. The latter, with its modern mode of treatment, is but a decadent rudiment of the foot of primeval man, or his anthropoid progenitor, which in grasping power, length of toes, exposure and manifold uses once approximated the hand. In it we have thus a type and norm of how organs and sensations, once elaborated, but now shriveled and atrophied to a pulpy residuum, appear. The throat and inner part of the thighs, so much more exposed since the erect position was acquired, are very ticklish. The sexual parts have a ticklishness as unique as their function and as keen as their importance. The faintest suggestion of them has great power over the risibilities of children. In most of the above parts the peculiar quality of these sensations is evoked only by contact, with some degree of pressure. These sensations could not have been established until the differentiation of parts was well made, and they must hence be less paleo-psychic than those for minimal contact with its "all-overish" sensations. They have, however, the primitive quality of undecomposability, reflex vigor often transcending control, and of being common to men and animals.

Tossing, swinging, etc., as laughter excitants, suggest the philophobia sensations described elsewhere in connection with gravity fears,¹ while novelty or the development of reactions for the first time in the individual, which are very old in the race, constitutes a standpoint, and probably a class.

The reaction time for pressure-touch in sensitive and vulnerable parts is very short, while that for minimal contact is very long, and appears to be about the same as that for pain. Whether, like the latter, its tract is less established in the spinal cord, or its peculiar sensations are mediated by sympathetic and vaso-motor fibres, we do not know. They no doubt belong, however, in the same group as pain, sex sensations and conæsthesias, and must be con-

¹ "A Study of Fears," G. S. Hall. Section I, Gravity Fears; AM. JOUR. PSYCH., Vol. VIII, No. 2.

sidered, in our opinion, as the true physiological complement of primordial sensations of pain,—traces, possibly, of the first pleasures not directly due to food and sex with which psychic development began. Just as, on the one hand, everything which caused pain was avoided, so everything which caused those sensations, of which these are the remnant, was sought. They represent, too, the satisfaction in activity of over-rested and therefore very labile centres, and perhaps the very touch-points of Goldscheider are, in a special sense, their organs.

Finally, it cannot be said too emphatically that most of the above points, as yet, lack final experimental demonstration, although, in a field so tempting, we cannot think that laborious research will be long delayed.

III. *Animals and their Acts.* Most familiar animals, their forms, actions, and, it would seem, especially their noises, are sources of great merriment for children. So are, secondarily, imitations of these by adults or other children. So intense is the pleasure arising from this source that often even the mention of the animal's name—donkey, monkey, pig, dog, jackass—provokes irrepressible laughter. Many nursery songs and games give abundant illustration of this fact. In our returns the order of frequency in mentioning animals as mirth-provoking is dog, cat, pig, louse, monkey, rooster, crow, chicken, duck, ape, goose, sheep, cow, horse, polly-wog, parrot, turkey gobbler, frog, owl, etc. It is interesting, and indeed surprising, to see how even the suggestion of a grunt, squeak, bark, hum or buzz, snort, whinny, bray, quack, caw, mew, cluck, bleat, squeal, croak, crow, chirp, touches the risibles of children, especially, of course, if they are where they ought not to laugh, and how much pleasure some of the animal calls which Mr. Bolton has collected give. Many boys become virtuosos in imitating various animals or the songs of birds, and always to the intense delectation of their mates. Young children sometimes laugh with such abandonment at some special imitative animal noise that stories that abound in them have to be modified. Of all the sounds enumerated, animal noises greatly predominate over all others. It is less the elements of suddenness or strangeness that cause the funny feeling, than it is the direct suggestiveness of the animal itself.

The antics of animals are a source of great amusement to children. They pull down the corners of the eyes and pull the mouth open, put their hands to their ears, crawl like snakes, root like pigs, fly like birds, swim like fish, catch and devour prey, make faces, wear animal masks, form shadow pictures, watch animals and laugh at and perhaps imitate their

every movement, personate trick animals. In 33 cases imitation of animals became persistent and troublesome. Some children desired to be, and others thought they were becoming some favorite animal. They play that they have claws, trunks, tails, tusks, big teeth and eyes, eat, drink or sleep, walk, play like animals. Games that involve catching or grabbing are often very mimetic of animals, and are always hilarious. The element of suddenness, too, often intensifies this factor. The wearing of animal masks, of great variety, has always been a source of great pleasure for children, and even plays a very important part in the games and ceremonials of the Chinese, most European folk-lore and amusements, in mediaeval revels and in savage dances. Pinning on tails, ears, horns, feathers, mane, wings, going on all-fours, enacting the animal eposes that have come down to us from the middle ages and from remote antiquity, with the aid of these accoutrements suggest that if, according to Lotze's theory of personal adornment, we feel ourselves extended to the tip of every ribbon or skirt we wear, and feel pleasure in thus extending and transforming the fixed limit of our skin-bounded ego, children must approximate the animal consciousness by these devices. On the other hand the long struggle of man with the other animals for survival and supremacy, the history of domestication, the folk-lore and religion of totemism show us what a rôle animals have played in human fear, reverence and even love in the past.

Modern studies of anatomy show that not only every organ of the human body is inherited from an animal ancestry, but that we all have some hundred and forty rudimentary organs which in lower animals were essential, but which in man are atrophied by disuse. Whether, or if so how, these dwindling parts modify human consciousness, we do not know. Nothing would be more rash than to assert that the fact that both the bones and several pairs of muscles that are still represented in the human coccyx has anything to do with children's amusement of pinning on tails. Nothing, however, is better established than that there is a closer rapport between animals, especially those that are domesticated, and children than is the case with adults. From the myths of feral children living with beasts to the familiar facts that domestic animals are often more nearly related and in closer sympathy with children than with adults, and from the fact that rudimentary animal organs are relatively and often absolutely larger in children than in adults, to the greater similarity of the early vocal utterances and gestures, as well as of infantile psychic states and processes to those of animals, we cannot argue, but only conjecture and wonder.

The more we know of animal instincts the more we are impressed, not only with their marvelous adjustment to their environment, but with their vast range, volume and complexity. The deep-sea organisms, the coral insects, migrating fishes, birds, animals that hibernate and estivate, nest building, quest of food, avoidance of enemies, the manifold marvels of the insect world, animal societies,—all these taken together represent an adaptation to conditions compared to which the entire human psychosis seems limited in range, artificial, and honeycombed with self-consciousness in method, and on the whole monotonous and narrow. It is easy to imagine totally different orders of intelligence as great as that of man, unfolded under conditions of life as different as his from that of birds, fishes or earth-worms. The life of childhood, from its very nature, is nearer the parting of the ways which open into all these undeveloped possibilities. Its more generic soul lingers with the charm of these upon it. It sympathizes with, pities, takes the place of, imitates many species of life and catches glimpses of the universe from these many and very diversified standpoints. This wide-ranged childish capacity is intimated in metempsychosis with its theories of incarnation in every possible and often impossible form of animal life. Just as adolescents stretch the soul by having a series of crazes, fads or enthusiasms, more than if they go to seed on the first one; just as Hippias would learn something of all trades before he sought mastery in one,—so childhood widens the range of all its powers by these close sympathies with animals, and also gets a far more vivid impression of vanity from knowing the peacock, cunning from the fox, boorishness from the bear, stubbornness from the mule, slipperiness from the eel, glory and patriotism from the eagle, strength from the lion, etc.

The pleasure element in all this must be carefully distinguished from that of Groos, whose theory of play as direct preparation for the activities of adult life (*Vorübung und Einiübung*), is obviously wrong here. As an at least partial explanation we here propose the following new view: Rudimentary organs need to be not only developed, but often used in order to dwindle in form and function, and to make place for the next higher organs and functions for which they, in the higher forms of life, are mere, although indispensable, succedanea. Stimulus and use, at a certain stage, seem to be necessary, not to make them develop, as is the case with most tissues, as all Lamarckians hold, but to directly cause their gradual atrophy. Whether the latter itself is the stimulus for the growth of the next higher organ and function, or whether these are mainly developed under the direct influ-

ences of the stimulus, we do not know. Now there must be therefore a class of activities, absolutely without direct use for the future, but indispensable for the development of higher powers, and the above reactions of childhood to animals must, we suggest, involve elements of this kind. Just as on the Aristotelian theory of Katharsis men see exhibitions of cruelty and crime on the stage to their great delectation, and thereby discharge instinctive tendencies to crime in their own souls without harm to others, and at the same time develop the power to control such tendencies in the future, so children's play with animals marks the harmless development of rudimentary animal instincts as they pass to their needed maximal growth, till the next higher powers that control and subordinate them are unfolded, thus recapitulating with immense rapidity a very long stage in the evolution of the human out of the animal psyche. The pleasure element here is great because the unfoldment is so spontaneous, rapid, and because nowhere is so large a section of the generic development of the race condensed almost within the range of the consciousness of the individual. The best illustration of this is probably found in the gradual reduction of childish fears under the influence of growing knowledge, and this is so important an element in childish joy and laughter as to merit more careful examination in the following section.

IV. *Recovery from Slight Fear.* This factor appears more or less in both the above rubries. Unusual gestures, mimicry of dreaded creatures or acts, the simulation of anger, the parodied biting or eating, jumping out at, and peek-a-boo, pretended fights, pseudo-scares, such as simulated lameness, cramps, fits, automatic movements, grimaces, etc., if very carefully adjusted to suggest, and then instantly and completely disarm fear, or if repeated, so that the subsequent pleasure can be anticipated before the fear has become too intense, are perhaps as certain to provoke laughter as anything. Here appears the contrast which many writers think a dominant factor in the ludicrous, as well as Herbert Spence's "descending incongruity." The shock or fear element seems to increase irritability, and the energy thus made labile overflows in all the phenomena of cachinnation. These nursery experiences again tend to lift the child above some fears, so that the pleasure of transcending them and laughing at what had just been feared is also involved.

Closely connected with, and often a part of this fun psychosis is the pleasure in unusual acts and attitudes generally, such as walking, speaking or acting in some funny or exceptional way, doing *outré* things, making faces, many forms of caricature, and especially of practical jokes, involving

grotesque mishaps for the individual, or for others. The fear element in many childish games is often no less fascinating than the forms of dermal titillation; possibly, too, the analogy between them may be far closer than we are wont to think. Just as we take pleasure in mild and easily overcome fright, because thus we are stimulating rudimentary psychic organs to gradually vanish and make place for others, which could not exist without their mediatizing function, so love of dermal friction may reverberate with remote ancestral echoes, and develop traces of old and ruder impacts into higher forms of tactile sensibility. At any rate, the overcoming of old and hereditary fears seems always to involve the generation of tension and then the discharge of pent-up energy.

The importance of a wide range of well developed but not too intense fears in early childhood has not been sufficiently understood. Perhaps nothing is more effective in developing attention to its full power, and also deepening and multiplying interests. If it be true that one of the chief functions of knowledge is to reduce fears, it is not yet realized what a vast source of incentive to knowledge can be derived from fears. Psychic zest and intensity of joy are rarely greater than just at that moment when the child is in the act of learning how to cast out fear, when it first touches the dreaded dog or other animal, and finds it harmless, when it braves its fear of falling and walks its first few steps, when it first defies solitude or darkness or dread of falling, etc. To be able to substitute a joy for a dread, to conquer a hitherto forbidden field of either thought or action, to enter by sympathy into a new form of life, formerly barred to it by dread, constitutes one distinct element in the very manifold causes of laughter, because it again widens the range of the soul's activity instead of contracting it as does pain. This philophobic experience seems not unworthy a name as unique as it.

V. *Laughter at Calamity (Schadenfreude)*. In reading over the returns to this questionnaire and that on teasing and bullying, and several others, a very dark side of human nature becomes painfully real and apparent. It would be hard to find any disaster so great that it has not been a source of genuine mirth, not only at scores of petty misfortunes, like the loss of hats in the wind, falls involving the breaking of eggs, spilling of sugar, berries, etc., turning of umbrellas, but severe accidents involving the gravest pain and danger to life and limb, and even death itself, may provoke unquenchable laughter. Often children and even adults laugh when they know they should not, till they are ashamed, until it pains them, and say they must

laugh if it kills them. A little girl, described by Mr. Russell, danced on the just made grave of her dearest playmate, chanting over and over, "I'm so glad she is dead and I'm alive," in real glee. In a well attested case from the west, which was especially investigated, two boys of 9 and 11, after seeing the scenes of butchering day, killed, dressed and quartered their baby sister, imitating with great delight the details they had seen. Not a few of our correspondents confess with genuine abasement that underneath a strong feeling of grief at the sickness and death of their friends, there is an undercurrent of satisfaction, and even joy, which sometimes makes them feel that their sorrow, though tearful, is superficial and hypocritical. It is unpleasant to dwell upon so painful phenomena, because it suggests that human friendship and sympathy have not yet become very securely established in place of the old war of all against all, which characterized the long ages of struggle for survival. Primitively, death of friends meant more food for the survivors, and even yet involves a distribution of effects. Now, too, it means new places, added opportunities, and sometimes new and closer friendship between survivors. The baser passions of envy, jealousy, hate, also may find real pleasure in the extinction of life. Pain and illness often cause secret satisfaction, which is recognized with dismay and confessed with mortification, even when they befall those who are really loved. It is sad to reflect upon the results of honest introspection and careful self-analysis upon this subject, which suggests hereditary rudiments so carefully and instinctively concealed by the higher impulses of human brotherhood, but which still lurk about the roots and taint the pure fountains of benevolence and philanthropy.

In anger, as a future paper will show, laughter in a few rare cases, not hysterical, appears when the victor has attained his object, and defeated, maimed, even slain his antagonist. A boy of 10, in a street fight, danced and screamed with laughter after he had stabbed and cut his playmate to death. Another, of 5, pushed a little girl from a high window and capered and shouted with pleasure that she was bruised and mangled by the fall. This instinct to gloat over the suffering of others is far more commonly directed towards animals, but some children find great apparent joy in venting their spite in secretly setting fire to buildings, breaking valuable ornaments and furniture, puncturing bicycle tires, rage against children who are loved by others whose affection they desire for themselves. The rapture of anger, when it completely attains its goal, is not confined to children of marked morbid or criminal propensities, but may break out in those

of normally good nature and kind heart like a sudden obsession or insanity. On the other hand there are natures that seem to be almost without natural sympathy, as every criminologist knows. In many, and perhaps most, there is a period, commonly brief, before the social instincts are unfolded, when the infliction of extreme pain is a passion so dominant as to lead Ireland, who describes its extreme form in monsters like Heliogabalus, Caligula and famous modern criminals, to designate it as the insanity of power; children, who can effect little that is good in the world, can develop the sense of being of great consequence in their immediate environments, not only profoundly affecting the course of things about them, but indulging the morbid passion for notoriety by unnatural and sometimes enormous crimes against both person and property. The sense of being able to bring things to pass, and of being the cause of intense feeling and great activity, thus may come to express the early crude and blind stirrings of ambition in natures of unusual strength, the factors of which develop in irregular or inverted order.

Weak natures that cannot excel in the open field of fair competition and natural selection, are no doubt always tempted to resort to the unfair means of removing or handicapping rivals in life's race. Exultation, then, has a common element with successful ambition. Jealousy has its own joy. The criminology of adolescence often shows this feature. It is manifested in ancient songs of victory, paens, triumphal marches, and shades over into the exquisite joy of teasing. It all shows how inveterate and primordial selfishness is, how slow and hard are the stages by which it is inhibited, and is in line with the current theories by which pleasure attends everything which is expansive, whether in soul states or in the environment.

Again, as if to illustrate the theory of Nietzsche, that pity is an unworthy human sentiment, children are often prone to imitate and exaggerate physical and psychic defects. Our records abound in descriptions of mimicry of lame children and adults, of bow-legged men, of ugly old women whom gangs of boys follow and hoot, of both spastic and tabetic gait of paralytics, of cripples without legs, beggars who hobble or walk on their knees or use crutches, of humpbacks, idiots, the blind, deaf, foreigners, etc.; while birthmarks, scars, dwarfs, deformed features, ties and automatic movements of limb or face, illiterate expressions, and even the twinges and convulsions of extreme pain, evoke mocking and hilarious laughter. Some young women have special and imperative risibility when they hear of failures in business, when their brothers, sisters or mates are punished, or giggle at any

trouble which befalls their acquaintances (*F.*, 16, *e. g.*, must laugh whenever she hears or reads of people who are either sick or poor. *F.*, 18. Has to laugh at all queer people or negro children), and specialization in the sense of the ludicrous, as excited by defect, loss, or oddity, is not infrequent. Stuttering, provincial speech, brogue, foreign accent are frequent topics for these virtuosos of mimicry, which are often exaggerated to the point of caricature. Such cases mark the transition from pleasure in misfortune to that which we are so prone to take in what is exceptional and unconventional. They also illustrate the proneness of childhood to explore all the possibilities of human life. This is especially true of such imitations when in solitude. When they occur before others, the alien motives of desire of applause for cleverness and skill come in. The laugh of the on-lookers is in part admiration of imitative cleverness, but also partly exultation over defect or eccentricity.

VI. *Practical Jokes.* Closely related to the impulse to laugh at the defects and calamities of fate is the instinct of rigging, coarse horse-play and clapping the fool's cap upon some innocent and unsuspecting victim. It would be easy to fill our space with records like the hiding of hats, the sewing up of sleeves, removing the slats from beds that the occupant be doubled up like a v, painting pansies on the bald pate of a sleeping uncle, upsetting wagons, painting cows, hoisting calves to college belfries, bent pins stealthily placed in chairs, pinning papers and legends, etc., upon the garments, generating noxious fumes, sending bricks done up in dainty parcels, cutting hair and whiskers, ducking, mock initiations, painting pickets, doors, statues in unseemly form, concealing books, clothing, glasses, doctoring food, sending on fictitious errands, condemning to do absurd and ridiculous things, awaking every kind of false expectation, modes of frightening of scores of kinds, and all the historical traditions of Hallow-e'en and All Fools' Day. Flögel's "Geschichte der Hofnarren" (1789), and Doran's "History of Court Fools" (1858), show us what rude, cruel practical jokes were played by kings, court and cultivated people a few centuries ago. Nero cut a man in two to convince him that he was not, after all, a single person, but two. Another Roman emperor invited a friend to a large banquet, and uncovered a dish in which were the heads of the wife and children of his guest. A cheap comedy theatre shows us how the practical joke, banished from the cultivated classes, where it formerly held sway, still prevails among the lowly, as it does among savages and children in a still raw and more fleshy form. The greater the discomfiture or even pain, the madder and more

furious the fun. Personal rights are no barrier, and respectability is a favorite mark for this crude pastime. Goethe well says that nothing is more significant of men's character than that which they find laughable. In these cases common human sympathy and trust of man in man seem quite suspended, and the pleasure often seems about evenly divided between the perpetrator's complacency in his own cleverness and inventiveness, and his exultation over others' pain. The dominance of the latter factor is very commonly seen in the lowest of all these cases, where originality has quite decayed and only the most commonplace and crude devices are resorted to. It is to be hoped that those writers who believe that on the whole mirth is not only growing more refined but less bitter are correct, rather than those who believe that the reverse is true.

As quickeners of dull wits the function of the practical joke is often of great importance, and there is much to be said in favor of many forms of the much-abused college hazing. Many a youth would be greatly improved by it. Its special uses are the following: Many a callow youth has been reared in an environment in which he has acquired a premature self-satisfaction and poise which veneers the soul against the infection of needed knowledge and hide-binds moral and sometimes even intellectual growth. A good course of rough and roistering treatment by his peers tends to make the nature flexible, and to prevent inspissation of character. Again it is an often sorely needed lesson in the control of temper and in hardening hypersensitive minds which are liable to find fancied neglects, and whose *amour propre* is so easily wounded. The trials and reverses of life are in some degree anticipated, and the soul is seasoned to bear their strain. Who cannot name in the sphere of his own acquaintance young men who would have been improved by this rude tonic, injurious though it is to some? Again, the practical joke offers a field for real ingenuity and invention, sometimes in making the punishment fit the crime and often in opening new sources of merriment in this somber world. A collegian who is condemned to kiss every baby he meets in a city street for a day, to wear his coat wrong side out for twenty-four hours, to wear a placard with the legend "kick me," to work for a day cleaning spittoons or sewers, to engage in a beer duel with a cleverly devised comic ritual, is surely not greatly injured, and may be given some needed flexibility and docility as well as taught to control his temper. But in all this group the law of rudiments is dominant. The practical joke is war, cruelty, torture reduced to the level and intensity of play, and must not tran-

seend its bounds. To give and take in jest what was once the wager of life and death, marks a distinct though late recapitulatory state of the development of the soul. It is the culture of religion, art, literature, education and civilization generally which has reduced these fierce and often brutal propensities, and that probably chiefly within the historic period, to their present harmless play forms. The ready acceptance of these cruelties by the victim is instinct's acknowledgment of this real need. Of course forms of the practical joke are found among all savage races in their reduced play form, and sham fights are constantly seen among animals. But besides their function as preparations for future activities, they also stimulate like all activities of rudimentary functions, they serve the purpose of discharging over-rested centres, stimulating primitive impulses not to grow, but to dwindle, and evoking their proper correctives. Men are thus more peaceable for sham battles, and the practical joke allows a harmless vent for the old anti-social instincts, and excites and establishes the dominance of higher powers.

VII. *Caricature.* Perhaps the next highest form is the impulse to that kind of ridicule often designated as "running on," "setting out," etc., in which acts, features, or traits are exaggerated or made ridiculous. Often naïve and even beautiful things are so distorted that the victim, especially if a child, comes to feel shame and perhaps morbid self-consciousness, where confidence and even pride would be justified. Some artists develop amazing capacity to see and depict absurd and perhaps animal features in the faces of public men, and country humor abounds in half-real, half-fancied eccentricities as its stock in trade. The colored man, the German, the Jew, the Yankee, the Irishman, the countryman, the Bowery man, the dude, the cockney, the typical French or Englishman of the comic stage owe their mirth-provoking quality to clever caricatures. So do the imitations of the mannerisms of great actors or orators, singers, etc. College dramatics abound in this and caricature of actors, professors, of unpopular men, freshmen and the other sex. To this mimicry owes its sting, because imitation must be true to life, but with certain parts loudly colored or unduly emphasized, like the magnified keyhole in a child's drawing of a house, or buttons, or pipe in the picture of a man. Every age, community, or often person, has its own strict and often rigidly conventional ideas of what is proper, and every real or fancied deviation attracts consciousness and invites attention. By this means not only fashion, but sometimes good morals and even the orthodoxies of faith are enforced. Manners and the customs of good society find perhaps their very

strongest ally in representations of their violations parodied into absurdity. One function of ridicule is, therefore, to enforce a consensus, whether of the old against the young, or conversely of the wise against the ignorant, or *vice versa*, of party, sex, modes of life, against recalcitrant or exceptional individuals, or against each other. Nothing is done which forces others into absurdity as in a practical joke, but ridicule takes on a function of criticism and rests upon clever misrepresentation of the actual, or gloats over lapses from some standard which, though it may not be formulated, must be very real and definite from which to measure all deviations. When these are made to seem most ridiculous the laughter is most confirmed in the norm or standard.

Here we recognize, still more clearly, the sense of superiority always implied in ridicule. The victim's egoism is abased and, in his humiliation, he may lose self-respect, especially if conscious of the least real ground of ridicule. Very incidental and unconscious acts may be rudely dragged into prominence, and in this way, too, real self-knowledge may be distorted. The victim has the unwelcome task of re-adjusting both his self-knowledge, and what is far more serious, his self-valuation. Society thus resists variation and differentiation, and all reformers, inventors and original souls who have struck out new ways for the race have been made food for the laughter of their contemporaries, while they have often turned the laugh against their persecutors. Thus inertia resists change and psychic types strive to perpetuate themselves. Even ignorance is very clever at burlesque of what is above it, and thus seeks to drag it down.

Caricature may have its root in simple humor, which laughs with the victim, or in satire which laughs at him. The first is a valuable school of human nature, of which it singles out and studies the various elements as parts of a dissected picture. Not only the soul itself, but society has been organized in the remote past by the reduction of ideas, sentiments, acts, sometimes by means of their opposites and sometimes by other needs for restraint. Caricature suggests this time when the soul's various elements were more unrestrained, and thus far more developed. Just as we laugh at animals that have long noses, ears, and other features that evolution has reduced and made harmonious, so psychic traits, untamed and raw, or yet unconcealed by conventionality or by self-consciousness, arouse laughter as an atavistic reverberation, just as we are most ticklish at those points of the body which are most vulnerable. Part of the pleasure here is thus due to expanding the soul to sympathize with a wider range of traits than the individual himself.

possesses, and is reverberatory of a past we know not how remote, and an exercise for rudimentary organs of the soul which come into their unfrequent and evanescent functions before they are slowly transformed into higher ones. Humor is based upon sympathy, the field of which caricature enlarges, enriches and diversifies. Humor may evoke sympathy not only with weakness and psychic defect, but with vice itself.

Satire, on the other hand, brings out or caricatures on a basis of truth like humor, but with the opposite effect of destroying sympathy and evoking contempt and aversion from perhaps the same qualities that humor inclines us to love. It comes into power very much later in life and at a much more advanced stage of culture and civilization. Its caricatures are more often those of defects or active sins than of mere eccentricities. The laugh it evokes is bitter because the scorn and contempt are merited, and Hegel has well characterized an age of satire as one of approaching involution and change, when old sanctities are ceasing to be revered. It is a mode in which an old culture or consciousness, or civilization begins to be sloughed off or molted to make room for a better one. Hence the laugh of satire can never be very hearty, but must be somewhat forced, even when brightened by wit. If it deepens into cynicism and misanthropy, it may almost as readily evoke tears as laughter, and hence need hardly be considered here. Sarcasm, which is one of the stings of satire, is very rare among school children. It implies a stronger sense of evil than they have developed, and its use by parents and teachers should be very rare, and only with the most careful precautions. Because while it very rarely excites laughter, it is very prone to rankle and fester in the soul for a long time afterward.

The genetic root of caricature is, no doubt, largely sympathy. The mother exaggerates the most beloved traits and acts of her child, and her laugh is that of humor, with its object, and not at it. Her pleasure is that of entering into the infant's psychic states. Inability to do this measures her limitations. All imitation is, at root, a kind of flattery. When bad traits appear in those about us, or good ones become excessive, the deep educational instinct of the race has invented ridicule as a method of self-knowledge. As if it knew that self-consciousness was deeply and originally a therapeutic agent, and the soul is infected with it by ridicule just at those points where reconstruction is most needed. Its method, which is exaggeration, is admirably adapted to its purpose, and marks the introduction of an es-

sentially new factor into the psychosis of laughter. In the preceding forms it has been mainly expansive, now it is restrictive. Its function is not primarily the joy of the on-looker, but the enforcement of some orthodoxy, consensus or propriety upon a victim. The implied superiority of the laugher is strongly present, but cannot transcend a certain degree of contempt, beyond which laughter is impossible. Ridicule is therefore punitive, and is sometimes one of the hardest blows that can be inflicted upon one's self-respect. Its laughter is never genuinely hearty, although it is often affectedly so, unless there is a degree of good will at its root. Another element in this extremely complex analysis is due to the ingenuity of the ridicule. In satire and sarcasm, however, the element of sympathy is reduced to a minimum, and there is always a degree of bitterness, and this saps the strongest roots of laughter, so that the treatment of these subjects hardly belongs here.

VIII. *Wit.* This seems, at first, to belong to a very different category, and to have little connection with any which precede. It involves elements in the analysis of which there has been the greatest difference of opinion. Unexpectedness, suddenness, "descending incongruity," have been the chief traits ascribed to it. The quick perception of unusual relations, the opening of new brain paths, the unexpected, but not the unpleasant,—these and other conceptions and definitions of it suggest some break of continuity in thought. Repartee is wit for two. The conundrum and enigma ask for instead of give the unwonted relation. Wit is thus mainly an affair of the intellect, and primarily harmless and without malice. The pun also belongs here.

Concerning wit also we have a new theory to propose. It has been shown elsewhere¹ that shock tends directly to neuro-psychic disintegration, and that dread of it is one of the chief motives that have made science and prevision. The shock diseases and lesions break up coherence in brains of great plasticity or convulsibility. Now, wit is of the nature of shock, reduced to almost its faintest terms, and is related to it somewhat, as the tickle sensations of minimal contact are related to the more definite forms of touch, or to dermal blows and lesions. Two factors are necessary—suddenness and a light touch.

Let us take a few very random instances from our returns. A young lady asks in a book store for "The Eloping Angels," and is told by the clerk that they only have its sequel, entitled

¹ See "A Study of Fears," by G. Stanley Hall, AMERICAN JOURNAL OF PSYCHOLOGY, Vol. VIII, No. 2; X, "Shock," p. 193 *et. seq.*

"The Heavenly Twins." The protensive wish is disappointed, but instead of an utterly irrelevant substitute, a very unexpected relation is presented, with a light suggestion of the forbidden or delicate. A child says champagne "tastes like your foot asleep." Here again the titillation of a minimal shock or constant element is manifest, but the pleasure is here heightened by both the naïveté of the child and the aptness of the comparison. When Charles Lamb saw the sign, "Beware the dog," and asked, "Ware be the dog?" we have in addition to the unexpected inversion a natural sequence of thought.

Culture and practice consist largely in inhibiting irrelevant reactions. By anticipatory suppression of these, the attention foresees its way and economizes energy. Wit, however, because it touches the soul in an unexpected zone, evokes a clotted mass of reflex movement of mind, perhaps not unlike a first experience before the will had repressed needless reactions. The intermittence of inhibition for the mental area thus unexpectedly invaded is thus analogous to partial psychic decapitation.

If this view is correct it helps us to understand why jolly people are often shallow, and why men of intense concentration, earnestness, and dogmatists generally, are so slow to see jokes. Wide irradiations and deep, ruddy tracts of association are inversely as each other. What Professor Boyesen calls the plague of jocularity in this country, which is manifested in the waggish propensity to lug in funny stories, no matter how irrelevant, and not only in after-dinner speeches, but on serious occasions, is not an altogether good sign. Of a group of foreign authors to whom Mark Twain's story of the "Jumping Frog" was told, not one thought it humorous, but either pitied the poor frog or condemned the fraud or the idleness of the pastime. Excessive mental ticklishness is probably to be set down as one of the neurotic stigmata, and a tickle club, described by one of our reporters, has its slightly morbid analogue in many a coterie of punsters and drolls. If northern races are prone to sadness, gloom, moroseness and tragedy, and the people of the sunny south are merry makers; if London is sober and Naples is quivering with rollicking fun, and resounding with laughter; if youthful nations enter the stage of history with jollity and games, as in the brightness of the morning and spring, while nations at the top of their career are graver and more sedate, —this distinction, we believe, marks the radically different psychic diathesis which separates the careless, happy enjoyment of life and the passion for novelty on the one hand from virile energy, perseverance and achievement on the other.

This view, too, helps us to understand the revulsion from old jokes. Children despise those who make effort to be funny, and especially those who endeavor to provoke a laugh by inadequate or familiar means. The "chestnut" starts irradiation over an old tract, but either inhibition checks the laugh or the energy of the unused centres has been consumed, and the effects of an anti-climax are manifest. I sat down one afternoon to read a careful and judicious collection of *facetiae* of all kinds which a colleague at Clark University had collected and had kindly loaned me. Most of the new ones in the first dozen or two were irresistible, and at not a few I laughed aloud alone in my study, but at the end of the first twenty or thirty minutes the quality of the collection seemed to have greatly declined and so lost its interest that I turned to other things. For several consecutive days, as I read on in his collection, this process was repeated till I learned that my fatigue curve for wit fell soon and steeply because unused tracts, although they discharged very easily, soon consumed their energy and were left temporarily in the condition of exhaustion until recuperated next day, only to be again deflowered and decrepitated. In this condition, solicitation to the act of convulsive laughter, especially if persisted in, may even provoke anger analogous to the irritability of fatigue.

As in tickling, again we have here, too, enormous fluctuations of excitability dependent upon the general condition of health, rest, mood, etc. Our feeling toward the personality of the provoker of wit is a very dominant factor. What in one person seems silly and even banal, in another is very laughable. We love to laugh for our friends, but consider it humiliating to give our enemy this power over us. Friendship and love sensitize all our risibilities as they do so many functions, and we delight in having those we care for discharge our powers of laughter just as animals love to be scratched by those of whom they have no fear. This power, too, makes for good will on the part of the hearer, but we steel ourselves with all possible energy against the assaults of those who are antipathetic. Laughter at wit implies compliment, and one of the earliest signs of love is sometimes the disposition to laugh at even the puerilities of the object of affection.

Cheap, superficial and even false connections between the discrepant parts of this complex and heterogeneous universe give pleasure because the long quest for unity of which monism, monotheism and science generally are the outcrops, has been so intense that even the flitting gleam of an extension of it into new realms gives pleasure like cloud land-

scapes at sea. The discontinuities of the cosmos seem less because irrelevant ideas salute as they pass. Some *jeux d'esprit* anticipate what later becomes settled truth, as a rude darning stitch by a child may determine how textures are to be quilted and embroidered together. Wit belongs to the penumbral, nebulous regions of intellect, and madness confuses the outlines and loses the proper perspective of the two. Hence, also, imagination may give the keenest pleasure because it opens the realm of the possible, which is always larger and better than the real in a world where the best things have not happened yet.

Must we not, then, assume that just as there are rudimentary functions that are slowly decaying, so there are nascent organs of soul, and perhaps body, the maturity of which lies far in the future? Man is not the larva of an angel, but of a higher superman that is to be. The imagination is the field to which we should look for the first expressions of a higher potentialization of the human race; because men dream visions they are prophets of a future of realization, where hope may attain some of its frnitions. In wit and fancy, present man is practieing for the higher man that is to be, just as some of children's games are preparatory to the duties and realities of adult life. We must not deem the pleasures of imagination, therefore, or the wider range of possibilities opened by wit, both of which so eurich the hard, stern world of present fact, as entirely without symbolic value as propheey. These bid us hope.

IX. *Laughter at what is forbidden or secret.* There are certain things necessary and essential to human life which society has stamped as improper or indecent, and certain parts of the body which it has agreed to conceal. Covert allusions to immodest things are sometimes a humoristic specialty. Things, acts, gestures, smells, hinted exposnres that ever so remotely suggest these things, are a prominent cause of laughter with young children, and *double entendre*, *risqué* phrases, tales or innuendos, obseenities expressed in innocent looking tropes or by ingenious euphemisms, have long made the chief source of laughter of simply vulgar people and roués, as is well shown in the voluminous new dictionary of such terms in French and English, just published, with many thousand of apt but unreadable quotations by an amazingly learned pseudonymous author.

It is hard to find all the causes of modesty and shame, but it is certain that very much of what is best in religion, art and life owes its charm to the progressively widening irradiation of sexual feeling. Perhaps the reluctance of the female first long-circuited the exquisite sensations connected

with sexual organs and acts to the antics of animal and human courtship, while restraint had the physiological function of developing the colors, plumes, excessive activity and exuberant life of the pairing season. To keep certain parts of the body covered irradiated the sense of beauty to eyes, hair, face, complexion, dress, form, etc., while many savage dancers, costumes and postures are irradiations of the sexual act. Thus reticence, concealment and restraint are among the prime conditions of religion and human culture. When the force of these restraints begins to be felt, the even hinted rupture of them relieves tension and suggests reversion to the long state of naked nature before shame took its rise. Like so many of the causes of laughter, this is thus in part reversionary, and involves atavistic reminiscences of the old Baechanalian, bestial paradise of license and abandonment. Here, too, as these instincts grow in strength at adolescence, restraints normally grow with them, and the domain of concealment extends to an increasing number of social forms and customs. It is amazing and almost overwhelming to realize how wide is the field of possible obscene allusions, and how a low but clever mind can give a turn of sexual reference to almost any expression or act, and how loud and long the laugh of coarser natures, and what an immense viability seems attached to obscene jokes and innuendos. Some jokers see vileness in everything, as extreme phallic theorists see sex in all historic monuments and forms. This source of wit and humor, however, is most demoralizing because it breaks through restraints on the stability of which civilization depends. Perhaps nowhere in psychic life is the tension greater than between these instincts and their reductives, so that the very suggestion of sudden freedom from the latter unhalts the strongest instincts in the animal kingdom of mind. This reversionary cause of laughter, which has not been hitherto recognized, we deem, as will later appear, one of our most important contributions to the subject.

Closely akin to the above is laughter at religious sanctities. The gods, priests, conceptions of post-mortem life, of retribution and reward, religious services, ceremonials and doctrine, Bibles, etc., have restrained and kept men in awe, and hedged life about with things that were forbidden; placed their taboo not only upon injurious, but also upon harmless acts. There have been periods in history when the soul asserted itself and threw off or broke through these cults, and then satire and ridicule have been most effective. Individual minds, both of low and high order, have denied and broken through these restrictions and laughed the gods and all the

paraphernalia of their religion to scorn in the effort now to assert man's pristine state of license, and now to make way for a larger and more adequate formulation of their religious instincts. A great proportion of the less boisterous laughter of the world has been at sallies against these sanctities, but toned down because their dominion over the spirit is so hard to break. In both cases, however, the assertion of freedom and liberty causes the joy.

X. *Laughter at the Naïve and Unconscious.* Helmholtz' theory of art teaches us that one element of aesthetic pleasure is in contemplating what is naïve and unsophisticated in self-consciousness, and getting a glimpse of human nature when it is stripped of all the disguises which convention and custom have constructed over it. Our returns are very copious under this caption. The innocent blunders of children concerning the meaning of words which are similar in sound or spelling, their fresh and literal interpretation of religious teaching about God, heaven, death, the soul; their clever interpretations of the real as contrasted with the conventional motives of human conduct; their explanations of natural phenomena; their animism; their ascription of human traits to animals; their imitations, curious questions and charming innocence, and spontaneity generally; —all these predispose adults to laughter, and often provoke it. Our interpretation of these data, too copious to quote, would supplement without in any way discrediting or restricting that of Helmholtz, as follows: We would postulate a strong and deep instinctive desire to know human nature, to understand motives, instincts, real springs of action. In childhood all these processes are more accessible to observation than in adults. We meet fundamental more than accessory traits, so that in childhood and genius, in addition to feeling that human nature is rich, true and sound to the core, as the syllabus of adult consciousness is not, we also gratify a unique psychological impulse which is deeply implanted in our nature. How deep and strong it appears not only in the pleasure in childish ways, but in things so diverse as love of pets and in that vast body of gossip which consists in the analysis of character, deeds and motives. Here we study man as he comes fresh from the hands of nature. The bullion is all unminted and without hall mark, and great as is the charm of nature where she is yet unsubdued by man and pours forth her energies with such exuberance and abandon, the charm of naïve human nature is yet greater, and its study is one of the strongest of all intellectual and social passions. That this primordial motive to child study has only just come to full consciousness and is but now

slowly developing a scientific method, is because of its vast complexity. It only develops and strengthens, but by no means supersedes the maternal love with which child study began.

XI. *Animal Laughter.* Both the children and adults who have answered our questionnaire have expressed the almost unanimous opinion that animals laugh, and most support their view by specific cases. All dogs laugh with their tail, although this intermittent movement is as different from the ha, ha of a man as is a dog's soul from his. A gentle wag is the dog's smile, but in extreme pleasure some dogs wag the whole body in a way that suggests a laugh of convulsive violence. So many children rock sideways as well as back and forth, or wag the head, a gesture which has always been suggestive of ridicule. Children think dogs smile with their eyes, and describe how they brighten or partly close in a peculiar way when they are pleased or sportive. It is an almost unanimous verdict, too, that the dog draws back the corners of his mouth if tickled in the ribs, and thus literally and physiologically smiles. They have "funny streaks" and run around in a circle, sometimes showing their teeth in a peculiar way, perhaps lifting the upper lip when they play with children they know, but never with strangers.¹ This is seen when dogs and cats play together.² Many dogs have a short bark that is peculiar to a pleased state; this children variously interpret eh, eh, ha, ha, etc.; others are taught to show their teeth and make facial grimaces when told to laugh. Dogs are said to open their mouths at play when they are not at all heated, but to laugh one in the face. Some do so if children blow in their faces, others watch the dog's under lip and think it drops with pleasure. Many details of play with dogs are given which show how firmly children believe dogs have a sense of humor and perpetrate practical jokes.

A few children think that purring is the cat's laugh, and others describe pleased expressions in the eye, and still others a peculiar noise. Some open the mouth when pleased, and the happy expression of their faces is mentioned, and some think cats laugh by rubbing against people, licking their hands, etc. Horses are said to jump, snort, paw, roll, etc., to express pleasure. They run, stamp, squeal, kick, stop suddenly, whinny, snort, lift their tails, shake their heads, bite trees, posts, run almost near enough to be

¹ "Anthropologische Vorträge," Heft I, Braunschweig, 1876, p. 43 et seq.

² "Mimik und Physiognomik," Detmold, II Auflage, 1886.

caught and then are off, play practical jokes on each other, prance, champ and shake the bit, etc. Children often describe pleased expressions in the eye, grinning to show teeth, and "a snicker." Menault, in his "Wonders of Animal Instinct," English translation, p. 273, says there are five sorts of neighing noticeable in horses. First, that of *joyfulness*, in which the sounds get stronger and sharper: the animal bounds and rears, but has no intention of doing any harm. Second, that of *desire*: in this the accents are prolonged and deep. Third, that of *anger*: this note is short and sharp; the animal tries to kick, to strike with his front feet, and if he is vicious to bite. Fourth, that of *fear*: grave and hoarse, seeming to come only from the nostrils, and like that of anger it is very short. Fifth, the neigh of *sorrow*: it is a groan, a kind of suffocated cough, in which the grave sounds follow each breath.

Perhaps what has hitherto been called the singing of birds may be called their laughter. They have always been thought very joyous creatures. The crowing of roosters the children think an expression of pure joy. In building their nests sparrows make a peculiar chatter of pleasure. Hens have a cackle, and many birds a peculiar chirp, cluck or coo, in spring in feeding. In their courting antics notes, made at no other time, suggest joy. They dance, flap their wings, and overflow with joyous notes when their cages are hung in the sun, in the morning when they are fed. The cackle of hens after laying eggs some children interpret as laughter.

Hudson explains the cackling of hens by the habit of their wild progenitors of laying their eggs and then flying for a hundred yards or so from their nest. Their cackle at that distance from the nest misleads its enemies and preserves its descendants. Its "joy" is therefore rather of the nature of an alarm note. So useless nowadays in the domesticated hen!

Calves, especially when first let out in the spring, gambol and bleat, as sometimes do frisking lambs. Monkeys grin, chatter, play jokes, etc. Children detect smiles on the faces of bears, elephants, and even wolves, tigers and other menagerie animals when they are pleased, and all agree that animals have their fun and a keen sense of humor, and are fond of jokes and have their own modes of laughter.

Children are by no means scientific observers, but intense anthropomorphizers, so that the verdict of all the children in the world upon this point would be utterly inconclusive. They are joyous and happy, and see pleasure in all that lives and moves around them. On the other hand they, like savages,

live in closer relations to the animal world than civilized adults. Their souls are less differentiated and more in rapport with the brute consciousness ; so that, on the whole, their opinion is interesting and not without some value.

Again, the facial muscles and also the organs of vocal expressions are, of course, very far less developed in animals than in men ; hence we should expect that manifestations of pleasure and pain would be more diffused over the larger muscles and the entire body, and be gradually focused in the face and voice, only late and high in the scale of being. Bearing this in mind, and remembering the law of kinetic equivalents, we must believe that there is a fundamental sense in which animals laugh, and that their dances, grimaces, noises, play, express the same erethism, euphoria, *Freude an Können, und Ursache-sein*, or whatever other theoretical cause we may assign to laughter. They are certainly ticklish, love to parody disobedience, play, fight, and are sometimes almost mad with manifestations of joy.

XII. *Miscellaneous.* We cannot doubt the fact of spontaneous laughter of children from the large body of returns on this subject. Infants smile on awakening in the morning before their eyes are opened, when or after they are being fed, etc. There are many cases of spontaneous laughter in older people when alone, and even when their thoughts are not bent upon anything peculiarly witty or especially pleasant. Other children laugh aloud when they are alone because they are glad the world is so beautiful, or that they are alive, are not deformed, are not animals ; in the morning they have been so happy that they must laugh, and perhaps elaborately seek excuse or explanation ; when they are through a task, realize their parents' love, or how protected they are against cold, or by night that their bed is so soft. On a beautiful spring morning they sit down and laugh alone, or laugh at every kind of stimulus or event, at blossoms, birds, beautiful clouds. Some mothers and kindergartners have a little game of laugh because they rejoice in life and to teach gratitude to God, making it thus a form of devotion or prayer. Laughter at the thought of present blessings, future and past pleasures, at the sunshine on the waves, at seeing children or animals play, or sometimes because they are so good, or again from no assignable cause, as the birds sing, may occur in a way that almost suggests the overflow of superfluous energy from centres discharged with no other stimulus than that of exuberant anabolism.

Old people's sense of humor is often said to resemble that of children ; their hearty laughs at nursery rhymes, at stories of their younger days, quaint vernacular idioms, their fond-

ness often for Bible jokes, their general lack of interest in enrent comicalities, papers, etc., and particularly their long drawn out details, their incessant repetition of old stories not only from year to year, but often reiterating the humorous nucleus of a tale over and over, their often unpleasant movements, expressions and noises, and their propensity to laugh at their own jests and smaller things as age advances, are all dwelt upon. Some of these traits are so characteristic that Herodotus says : The ancient Scythians always ate their old people when they began to tell old stories.

Insanity always readjusts the balance between pleasure and pain, and thus either increases or decreases laughter. This we believe to be an important generalization, and one that holds with rare exception. It is not true, however, that expansive and exalted states which widen the pleasure field always increase laughter, because often they are associated with a sense of greatness and dignity which are inconsistent with it. In settled melancholia laughter is forever extinguished and impossible. In progressive paralysis it is rare, but always profoundly modified from the normal. In hysteria and neurasthenia it is often excessive and alternates with tears, while in some forms of mental decay the psyche loses its sensitiveness for extremes of both pleasure and pain.

XIII. *Notes on Literature.* The many theories since Aristotle concerning laughter, wit and humor, hitherto published, have been lamentably metaphysical in their tendency, or have been exceedingly circumscribed in the range of their induction. Nebulous and narrow, they have furnished no firm foothold for further research. Hobbes ("Human Nature," Chap. IX, Section 13) sums up his view as follows : "I may, therefore, conclude that the passion of laughter is nothing else but sudden glory arising from some sudden conception of some eminency in ourselves, by comparison with the inferiority of others, or with our own formerly." Dryden defined wit as a "propriety of thoughts and words, or thoughts and words elegantly adapted to the subject." If true, the facts of Ganot's physics would be jests of most excellent pungency. Pope borrows from Dryden :

True wit is nature to advantage drest,
Oft thought before, but ne'er so well exprest.

Dr. Johnson : "Wit may be more rigorously and philosophically considered as a kind of *concordia discors*, a combination of dissimilar images or discovery of occult resemblances in things apparently unlike." The discovery that hydrogen and oxygen produce water, that potassium thrown

in water produces flame, would thus be strokes of pleasantry. Sir Richard Blackstone : "Wit is a series of high and exalted ferments." Locke describes wit as "lying mostly in the assemblage of ideas, and putting those together with quickness and variety, wherein can be found any resemblance or congruity, whereby to make up pleasant pictures and agreeable visions in the fancy." Addison adds to this definition that delight and surprise are necessary to make wit, and illustrates it thus : When a lover tells us that the bosom of his mistress is as white as snow, the simile is not witty, but it becomes so when he adds that it is also as cold. Dr. Campbell in his "Philosophy of Rhetoric" defines wit as "that which excites agreeable surprises in the mind by a strange assemblage of related images presented to it." Kant (in his "Critique of Judgment," Section 54, Barnard's translation) finds in incongruity and absurdity the basis of the comic. "Laughter is an affection arising from the sudden transformation of a strained expectation into nothing." The pleasure of the ludicrous results not from the mental appreciation of the circumstances in question, but from the life-giving qualities of the laughter ; "the lungs expel the air at rapidly succeeding intervals, and thus bring about a movement beneficial to health : which alone, and not what precedes it in the mind, is the proper cause of gratification in a thought that represents nothing."

Hecker ("Die Physiologie und Psychologie des Lachens und des Komischen," Berlin, 1873, p. 15) affirms that laughter is a consequence advantageous to the organism. He holds that in tickling, and also in laughing at a joke, the physiological accompaniment is an intermittent pressure upon the brain through an intermittent contraction of the minute blood-vessels therein, laughter realizing this by causing their congestion. Hecker supposes that in tickling there is a stimulus upon the vaso-motor nerves, causing an anaemia of the brain. The intermittent exhalations which constitute laughter have the purpose of counteracting this anaemia. He holds that the essence of comedy is an intermittent stimulus of the sympathetic nervous system, and that there is a rapid oscillation between pleasure and pain analogous to the phenomena of rivalry in the field of vision of the two eyes. Pleasure is passing over into pain and pain is passing over into pleasure (pp. 76-83). This is his explanation of wit due to ambiguity of meaning. His elaborate analyses are not adequate to the present state of knowledge.

The Rev. H. R. Haweis, taking a metaphor from meteorology, calls humor the electrical atmosphere and wit the flash. Thackeray describes humor as love and wit.

Vasey, in his "Philosophy of Laughter and Smiling," 1871, attempts no explanation of laughter, but thinks it very doubtful whether children would ever learn to laugh if they were not physically tickled, especially in a forbidden place, and deems excessive laughter almost morbidly convulsive. Man, he says, is not a laughing animal, and the habit is by no means universal, many savages being too stoical to laugh at all, agreeing with Chesterfield that a true gentleman may smile, but never laugh, habitual laughter being always a mark of shallowness, ignorance and vulgarity. We laugh at, but never respect the wit. Heraclitus, who wept at the follies of man, was wiser than Demoeritus, who laughed at them. Joke books are pathetic and so are the gags of low comedy. Man abdicates will and mind and distorts his features and becomes contemptible in paroxysmal laughter. Jesus never laughed; sorrow is better. The London Fun Club, with its low, practical jokes, suggests how desperate and intoxicated man may become under the influence of the pathetic desire to be funny. Schopenhauer (*Welt als Wille*, I, Sec. 13) says: Laughter never arises from anything else than the suddenly recognized incongruity between the conception and the real object that in some respect or other has been thought through it, and it is itself simply the expression of this incongruity. The greater and more unexpected in the apprehension of the laugher this incongruity is, the more violent will be his laughter. Herbert Spencer ("Physiology of Laughter," p. 206) would trace laughter through its successive causes, up to a distension of the cerebral blood-vessels. "Laughter naturally results only when consciousness is unawares transferred from great things to small—only when there is what we call a *descending* incongruity." The insufficiency of this theory is manifest indeed from the facts of the foregoing paper. Bain ("Emotions and Will," Chap. XIV, Sec. 39) finds that "the occasion of the ludicrous is the degradation of some person or interest possessing dignity in circumstances that excite no other strong emotion." Fleet ("A Theory of Wit and Humor," 1890) presents an "imperfection" theory which has some affinities to Spencer's "descending incongruity" theory. He attempts to describe in detail a number of "risible phases" which have some merit.

J. L. Ford ("Concerning Humor," in *The Bachelor of Arts*, Jan., 1896) claims that about nine-tenths of the humor of the stage or literature is nothing more or less than a sense of one's own superiority. The other tenth, "which is the most important part of the whole, as it comprises the finer and more advanced forms of wit and humor," he says he cannot

satisfactorily account for. "Careful study of the work turned out by these professional joke-makers reveals the fact that fully nine-tenths of their humor is founded on the simple idea of disaster or misfortune," p. 176. "Nearly all primitive humor is founded on this simple idea. In the English pantomime, in which many of the most ancient forms of jest are so firmly imbedded that they are in as fine a condition to-day as they were under the reign of the Merrie Monarch, all the fun depends upon the indignities heaped upon the different characters," p. 176. "For a great many years nearly all our national humor had for its foundations the mother-in-law, the goat, the stovepipe, inebriety, and the banana peel." B. I. Gilman ("Pain and Pleasure," this JOURNAL, VI, No. 1, p. 43) thinks "the perception of the ludicrous is not complete when the incongruity . . . has been discovered, nor does the pleasure of the comic proceed from its recognition. The completed perception of the ludicrous involves a sequence of a satisfaction upon a disappointment, and the pleasure of it is the intrinsic pleasure of the one sharpened by the excitement of the other." W. S. Lilly ("The Theory of the Ludicrous," *Fortnightly Review*, May, 1896) attempts a somewhat belated Kantian explanation. "The ludicrous is an irrational negation which arouses in the mind a rational affirmation." See also his "Four English Humorists of the Nineteenth Century," 1895. "The humorist, we may say, is an artist who playfully gives us his intuition of the world and human life." For short sketches of German theories the reader may be referred to those given by Dr. Ewald Hecker (*op. cit.*) or to Dr. Joseph Müller's "*Das Wesen des Humors*" (1896). For some French theories one may read Camille Mélinaud, "*Pourquoi rit-on? Etude sur la cause psychologique du rire*," *Revue des Deux Mondes*, 1895, pp. 612-630, or M. Philbert, "*Le Rire*," 1883. Mélinaud's article is excellent in its criticism. A. H. Keane (Ethnology, 1896, pp. VIII and 195) lays stress on the fact that "the facial organs of speech are non-existent in the anthropoids, rudely developed in fossil man, and perfected only in the later ages." Sully, Grant Allen, Wallaschek and others have in the main followed Spence, whose view was in a general way anticipated by Jean Paul, Schiller, Beneke and others, but is now met by an almost opposite theory in the recent work of Karl Groos ("*Die Spiele der Thiere*," Jena, 1896), who deems play not so much an overflow from unused centers or organs as practice for future activities. (*Vide infra.*) See, also, Dr. Louis Robinson's article on Ticklishness in the Dictionary of Psychological Medicine, and compare it with that of Sir B. W. Richardson in the same work on the Psychology of

Tears. See also Höffding's Psychology (Part VI, p. 290, English translation), also Piderit's "*Mimik und Physiognomik*." These latter views in general go beyond Darwin's "Expression of Emotion." Sir J. Russell Reynolds (*Lancet*, Jan. 5, 1895) has made a suggestive study, entitled "The Types of Students," in which he analyzes with a master hand the characters of five cases, whom he designates as Cyrus Vane Velox, David Superficialis Hurry, and the brothers Orbicularis and Longitudinalis Goodman. C. A. Witchell ("Evolution of Bird Song," 1896) accepts Darwin's view of the origin of voice, and traces all bird song to reiterated but identical notes of calling and warning in a way that is suggestive for views like those of Schiff and Heeker on the intermittent cause of laughter, and suggests an identical origin of all animal expressions of pleasure and pain. (*Vide infra*.) Play has thus a biological justification. Groos lays great stress upon the fact that the plays of animals are also the manifestations (*Ausübungen*) of the various instincts of their individual group. They are prophetic in the true sense both of the past and of the future. Groos' work is the best issued on this subject in recent years.

In answer to the request for that which had excited greatest laughter, the diversity was great. The following literary productions were specified in order of frequency: Artemus Ward, Peck's Bad Boy, Brownies, Huckleberry Finn, Topsy, Sam Weller, Chimmie Fadden, Pickwick, Ichabod Crane, Mary Wilkin's characters, Rip Van Winkle, Manley's Ghost, Barkis, and scores of others less frequently. Children specified stereopticon pictures of mice running into a sleeping man's mouth, a woman whipping her husband, Punch and Judy, a jug of water over the door to be emptied on the person opening it, parodies of familiar standard poems, tossing in a blanket, a goose in the teacher's chair, simple people, negro and other eccentricities, animals performing human acts, college boys playing cards, and all kneeling to pray when the professor rapped, and an almost interminable list of banalities, practical jokes, puns, conundrums, blunders, etc. All this suggests that the repertory of the modern merry maker is very large, and that we are very far from having rubries adequate to explain the vast variety of laugh-provoking specialties.

We are persuaded that all current theories are utterly inadequate and speculative, and that there are few more promising fields for psychological research. What we next need is to apply all the resources of instantaneous photography to collect laughs and smiles in all their stages in men and women, children and adults. These are so evanescent that

the collection we have begun shows differences from the traditional representations in art as marked as those found in the gait of the horse. Secondly, the resources of the phonograph should be applied to the vocal utterances of laughter. Thirdly, a still wider collection of returns to syllabi such as ours is needed. Fourthly, a very careful collection of thousands of the very best ancient and modern jests, on cards such as has been begun for ready sorting, until genera and species for some classification on a purely inductive basis shall appear. Fifthly, a very exhaustive review of humorous literature, proverbs, etc., with analytic intent. We must go back of speculation to rebase our theories upon very wide empirical data, as Aristotle is said to have derived his categories from an immense induction from all the topics of conversation in the streets and market. Nothing is plainer than that the old definition, such as "descending incongruity," a sense of superiority, "surprise," the Lange-James theory, Hecker's "contrast and intermittence" theory, the "unusual combination" views, L. Hill's "vaso-motor hub" interpretation, etc., are either utterly mistaken and misleading or entirely inadequate to the subtleties of nature, or mere literary descriptions of partial aspects of the subject. Hardly less so and merely verbal are the many definitions of wit, humor, satire, drollness, buffoonery, fun, comedy, joke, quaintness, the ridiculous, the pun, irony, banter, clownishness, caricature and mirth, found in the rhetorics and treatises on æsthetics, although these suggest a broader basis than do the philosophical theories.

Certain, it seems, although this paper is so preliminary and tentative, that hearty laughing is a good thing for children, and might be listed among their inalienable rights. Mad, wild, weird and almost barbaric though laughter sometimes seems, perhaps, reversionary and dissolutive in its nature, often convulsive in its intensity, on the whole, no doubt, like occasional crying for babies, it is good for the voice, lungs, diaphragm and digestion, produces needed increase of blood pressure to irrigate new forming tissues, develops arterial tonicity and elasticity, tends to range, flexibility and vigor of emotional life, gives an optimistic trend against its evils, and tones down into settled and less paroxysmal states and grades of pleasure as maturity advances. While we cannot agree with Hughlings Jackson's conception of fear as broken down anger, it is possible that æsthetic pleasures generally, genetically considered, and even some of the joys of religion and virtue, are laughter diffused, tempered properly alloyed with pain, and minted for general circulation through all our psychic activities.

ON CERTAIN OPTICAL PHENOMENA.

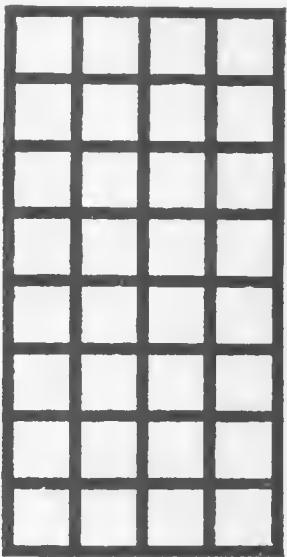
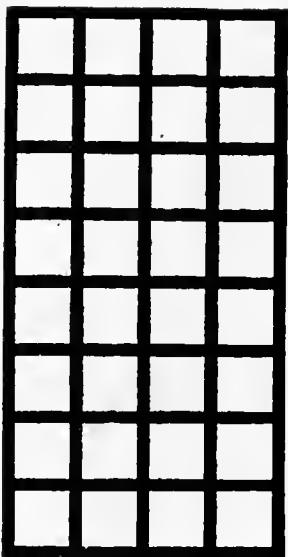
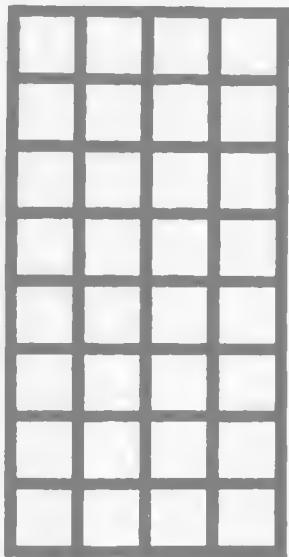
Some years ago, Prof. H. H. Donaldson gave to the Clark laboratory four large diagrams showing peculiar optical phenomena, but without giving at the same time any definite account of their origin and purpose. All, however, bore the legend "W. Preyer, *del.*," or its equivalent, and after fruitless examination of accessible list of Prof. Preyer's writings, I applied to him directly for references to literature containing explanations of them. In reply I received the following courteous letter. Availing myself of the permission given in the last sentence I publish the letter here with reproductions of the plates described. The reproductions have been made on half the scale of the originals; and in the case of the last, a wide black border has been made narrow. Otherwise the reproductions are fairly exact.

E. C. S.

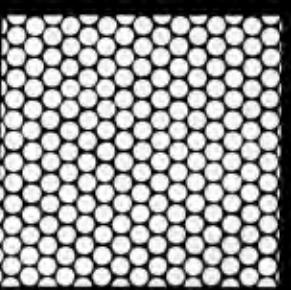
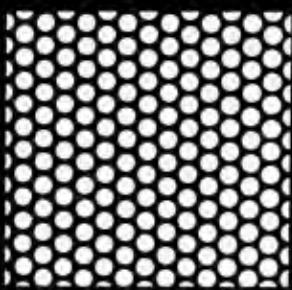
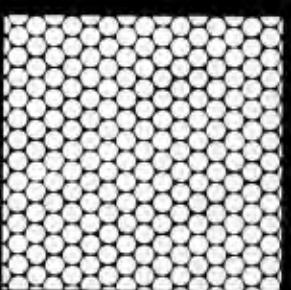
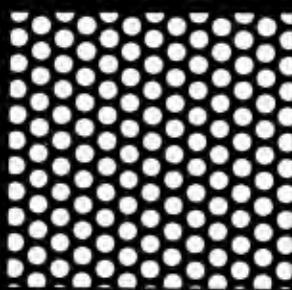
To Professor E. C. Sanford, Clark University, Worcester:

In reply to your kind letter, dear sir, I am glad I can furnish you with some particulars about the four plates. They are not taken from some work on color and optical illusions, but belong to a collection of plates which I intended to publish in the form of an atlas, so as to enable professors of physiology and students to study certain important phenomena of which I had spoken in my lectures at the University of Jena, and partly at Berlin—phenomena not mentioned or not explained, or not correctly explained in the text-books. This work never has been completed, because the publisher got into insurmountable pecuniary difficulties and failed. I therefore presented the copies, as far as they were finished and printed, to my hearers, explaining the meaning of every detail verbally. Only two plates, which do not seem to be in possession of your laboratory, but have a very peculiar psychological interest, are accompanied by a printed explanation, published in the *Jenaische Zeitschrift für Naturwissenschaft*. Perhaps I may find a copy which I can send to you.

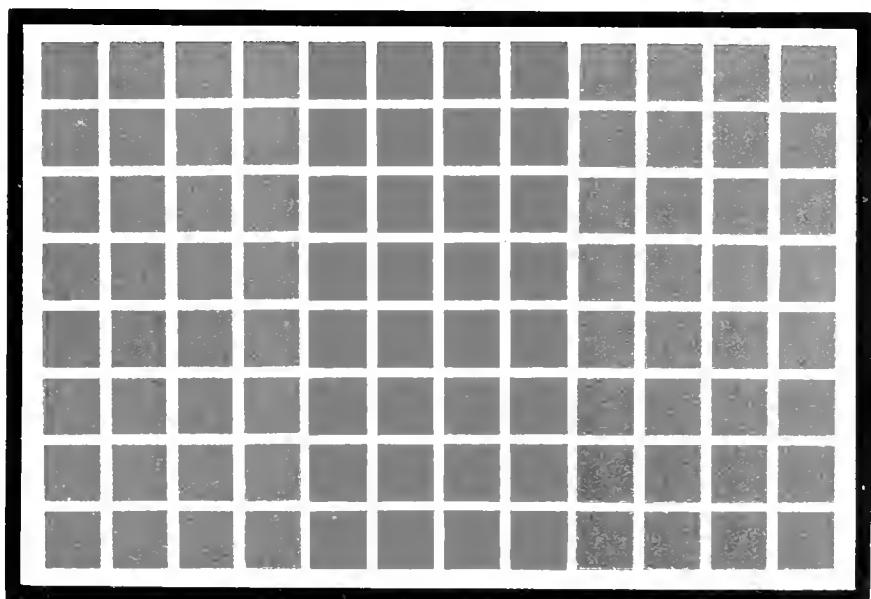
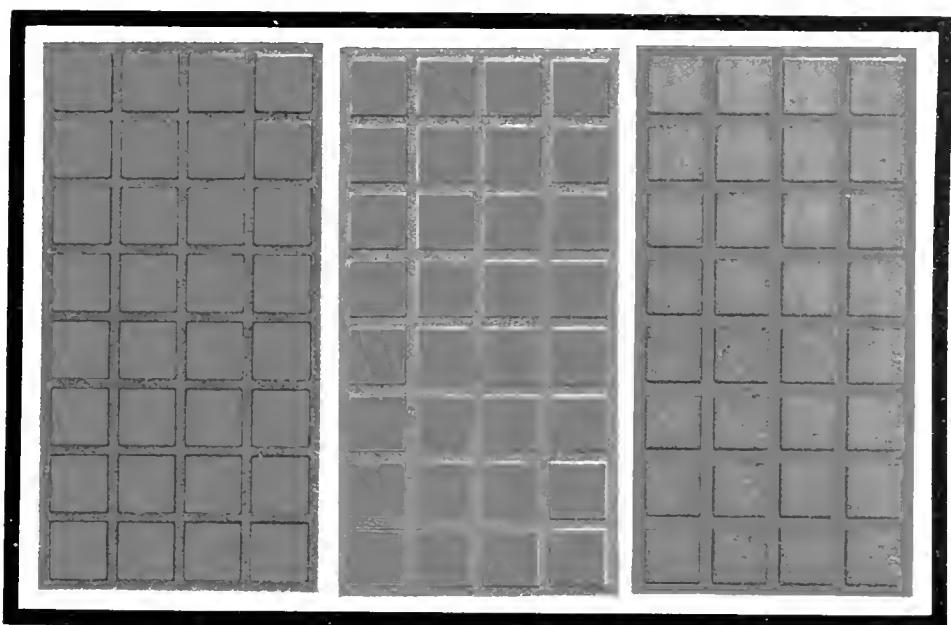




Taf. XL.



Taf. XLV



The first plate you mention I designed immediately after I had found out that the knobs of *Pleurosigma angulatum*, the test-object for microscopes, are not hexagonal, but circular. This is a matter of accommodation. Attach the paper to the wall of your room vertically about the height of your eyes above the floor and approach it slowly and rectilineally from the opposite wall until you very distinctly see the circles in one of the squares to be really circles (it will be the square wherein the separating black is of the maximum width), then, at least, two of the remaining three squares will appear to contain hexagons. A man, even endowed with superior faculties, might swear that one square contains only hexagons and another only circles, while all of them are seen under exactly the same conditions in the same broad daylight. So the fallacy of our judgment of forms, as soon as we come near the limit of our accommodation-power, is proved plainly.

Besides, this plate shows sometimes (I know not the *conditio sine qua non*) a new phenomenon of simultaneous contrast, namely, in the centre of the white disks with the broadest separating black ground, you will see a roundish gray spot, not sharply separated from the white ground.

The second plate you mention (probably marked "Taff. XLI") illustrates a similar fact. You see white or grayish white spots at every one of the intersections of the green, black or red bars. These dots, though not sharply defined, look more like squares than like circles. So it is proved that this optical illusion is independent of color, but not of form—I mean the configuration of the "inducing field" (*e. g.*, circle or square) alters the shape of the "induced." The production of the latter is easier if the accommodation apparatus is at rest, than otherwise. Besides, the phenomenon is all the more surprising (stunning to some individuals), when the difference of intensity between the bars and the squares is a maximum.

Your third plate, with the colored "inducing fields," shows the induced dots always of the same color.

The fourth plate you mention confirms this law even for complementary colors.

Sometimes you will see in the last mentioned three plates quite straight but not sharply defined lines, exactly equidistant from two neighboring squares, and ending in the dots. Their color invariably is the same as the color of the dots.

You will very likely find yourself some additional facts by varying the conditions, *e. g.*, taking colored eye-glasses, reposing the eyes in the dark for fifteen minutes, illuminating the plates by the electric spark, staring at the bars in order to get the after-image (*Nachbild*), which has no dots. But it

would be too lengthy to describe all this. I leave the whole subject to you. I shall be much pleased if you and other gentlemen find the statements in this letter to be correct, and some day will be able so explain the facts. The current theory of simultaneous contrast is quite insufficient, and Hering's hypothesis only partly agrees with my observations. So the field for new researches seems to me to be promising. Not being so fortunate as to find the connecting link of all the strange subjective phenomena, I dropped the subject long ago, and now hope that you may be more successful.

You are quite at liberty to make any use of this letter you may think proper.

Believe me, dear sir,

Yours truly,

Nov. 1, 1896,

Prof. Dr. W. PREYER.

Wiesbaden, Villa Panorama.

MINOR STUDIES FROM THE PSYCHOLOGICAL
LABORATORY OF CORNELL UNIVERSITY.

COMMUNICATED BY E. B. TITCHENER.

XIV.—A STUDY OF CERTAIN METHODS OF DISTRACT-
ING THE ATTENTION.

II.—DISTRACTION BY ODORS.

BY L. G. BIRCH, PH. B.

The present Study is a continuation of the work begun by Mr. Moyer in Study XII. Our aim is to discover a means of distraction that shall be (1) capable of gradation, (2) uniform in its working, and (3) applicable to normal subjects. Mr. Moyer's preliminary work with scents promised so well that it seemed desirable to make a direct test of the efficacy of odors in distraction. The experiments lasted during the academic year 1896-7. We supposed, beforehand, that a year would afford time enough for obtaining an answer to our question in the particular field chosen (discrimination of sound intensities). The result shows that a longer period is necessary. As the investigation cannot be carried on for another year with the same subjects, we publish the Study as it stands, though with full consciousness of its incompleteness.

Two sounds of different intensities were given by means of a fall-phonometer (Willyoung & Co., Philadelphia). The sounds were produced by the dropping of ivory balls upon ebony plates through distances of 50 and 55 cm., respectively. The portion of the acoustic room used for the experiments was curtained off in such way as to exclude echo or reverberation of any sort; and the apparatus was rigorously tested by the experimenter, before a series began, for the detection of qualitative differences between the sounds due to possible maladjustment of parts of the phonometer. The subject sat with his back to the instrument, and passed judgments of relative intensity in accordance with the method of right and wrong cases. The experiments fell into three groups :

- (1) practice experiments before distraction ;
- (2) distraction experiments ;
- (3) test experiments after distraction.

Four subjects took part in the investigation : Mrs. S. T. Oliver (*O.*), Miss N. G. Seymour (*S.*), Mr. I. M. Bentley (*B.*), and Dr. W. B. Pillsbury (*P.*). The writer of the Study was experimenter throughout.

I. *Practice Experiments.* All four subjects had had practice with the phonometer in 1895-6, whether in the course of investigation or in the laboratory drill-work. We therefore thought it unnecessary to devote any considerable amount of time to practice experiments. After a few days' work the percentage of *r* cases became practically constant for all. We then took the following standard experiments, in series of 20 :

$$\begin{array}{ll} B., 240 \text{ exp., } r=73.3\%; \\ O., 200 \text{ " } r=91\%; \\ P., 100 \text{ " } r=85\%; \\ S., 240 \text{ " } r=67.3\%. \end{array}$$

We purposely kept the height of fall of the balls the same for all subjects, thinking it well to test the value of the odor distraction upon judgments of supraliminal, liminal and subliminal differences. The limits 91 and 67 per cent. afforded a range sufficient for this end.

Unfortunately, although the percentage was 'practically constant' in these practice experiments,—the m. v. of the series being very small,—the event proved that our preliminary work was inadequate. The percentages increased as the experiments were continued. See (III), below.

II. *Distraction Experiments.* Not only did the subjects differ as regards power to discriminate sound intensity ; they differed—and this, also, we took to be useful for the purposes of our test—in their mode of reaction upon smell stimuli. *B.* and *P.* were familiar with the scents of the chemical and anatomical laboratories ; *O.* knew the odors of the plants which she had studied in the botanical laboratory ; *S.* was keenly affected by scents, pleasant or unpleasant, but was unfamiliar with names.

Fifty scents were employed : 1, oil of cloves ; 2, oil of tansy ; 3, oil of pennyroyal ; 4, oil of origanum ; 5, oil of spike ; 6, oil of orange ; 7, extract of coffee ; 8, extract of pineapple ; 9, extract of raspberry ; 10, extract of white rose ; 11, extract of violet ; 12, extract of heliotrope ; 13, powdered orris ; 14, tincture of iodine ; 15, paregoric ; 16, tincture of arnica ; 17, powdered licorice ; 18, oil of bergamot ; 19, bay rum ; 20, lavender water ; 21, menthol ; 22, veronica ; 23, banana ; 24, peppermint ; 25, carbolie acid ; 26, benzine ; 27, cinnamon ; 28, methyl alcohol ; 29, oil of thyme ; 30, olive oil ; 31, naphthalene ; 32, brandy ; 33, ammonium sulphide ;

34, bromine water; 35, spearmint; 36, camphor; 37, hemlock; 38, oil of turpentine; 39, anise; 40, rosemary; 41, Javelle water and chlorine; 42, vanillin; 43, formalin; 44, acetic acid; 45, rye whiskey; 46, absolute alcohol; 47, oil of bitter almonds; 48, cotton seed oil; 49, nitro-wurtzite; 50, wintergreen.

The small phials containing these odors were covered with paper; so that the subject could not judge of the scent by the appearance of the substance. The corks were numbered according to the above list. The phials needed for an experimental series were laid out in order upon a low table at the subject's side. At a 'Ready!' he took up the phial nearest him, and held it in his left hand. Two seconds after a 'Now!' had been called, the first ball dropped. As soon as the sound had been apperceived, the subject uncorked the phial and smelled the contents. After an interval of five seconds the second ball was let fall. Judgment was passed, first, upon the intensity of the sounds; and then remarks made upon the nature of the odor.

We supposed, before beginning the experiments, that a single smell would not be sufficient to fill up the full five seconds, and devised various ways of meeting the difficulty which would thus arise. In practice, however, the difficulty did not occur; the single distraction proved adequate in every case.

Following are four typical series, one from each subject. A height of fall of 55 cm. is represented by *a*, that of 50 cm. by *b*.

SERIES I. REACTOR O. JAN. 16, 1897.

Exp.	Stim.	Scent	Judgt.	REMARKS.
1.	<i>ab</i>	39	<i>w</i>	"Odor familiar; do not know the name."
2.	<i>ab</i>	40	<i>r</i>	"Pleasant perfume."
3.	<i>ba</i>	41	<i>r</i>	"Do not know it at all."
4.	<i>ba</i>	42	<i>r</i>	"Do not know; sweetish, like a flavoring extract."
5.	<i>ab</i>	43	<i>r</i>	"Pungent, like the horse-radish group."
6.	<i>ab</i>	44	<i>w</i>	"Do not know at all; never smelled it before."
7.	<i>ab</i>	45	<i>r</i>	"Whiskey."
8.	<i>ba</i>	46	<i>r</i>	"Faint odor."
9.	<i>ba</i>	47	<i>r</i>	"Like bitter almonds."
10.	<i>ba</i>	48	<i>r</i>	"No definite odor; thought of olive oil."
11.	<i>ab</i>	49	<i>r</i>	"Bitter almonds certainly."
12.	<i>ab</i>	50 no jdgt.		"Wintergreen."
13.	<i>ab</i>	1	<i>w</i>	"Familiar; cannot name."
14.	<i>ba</i>	3	<i>r</i>	"Spearmint."
15.	<i>ba</i>	5	<i>r</i>	"No odor."
16.	<i>ba</i>	7	<i>r</i>	"Coffee."
17.	<i>ab</i>	9	<i>r</i>	"Little like burnt molasses."
18.	<i>ba</i>	11	<i>r</i>	"Violet."
19.	<i>ab</i>	13	<i>r</i>	"Faint; do not know."
20.	<i>ba</i>	15	<i>r</i>	"Ipecacuanha."

SERIES II. REACTOR B. FEB. 10, 1897.

1.	ab	36	r	"Familiar; cannot name."
2.	ab	38	r	"Turpentine."
3.	ba	40	w	"Fruit-like."
4.	ba	42	r	"Paper-like smell."
5.	ab	44	r	"Do not know; not familiar."
6.	ab	46	r	"Alcohol."
7.	ab	48	w	"Do not know; not a strong odor."
8.	ba	50	r	"Peppermint."
9.	ba	1	?w	"Vague idea of the smell."
10.	ba	3	r	"Familiar, but cannot name."
11.	ab	5	r	"Like turpentine."
12.	ab	7	r	"Coffee."
13.	ab	9	w	"Do not know."
14.	ba	11	r	"Perfume."
15.	ba	13	r	"Perfume."
16.	ba	15	r	"No clear idea of the smell."
17.	ab	17	w	"Do not know; thought of coffee."
18.	ab	19	r	"Perfume."
19.	ba	21	w	"Unfamiliar."
20.	ba	23	w	"Doubtfnl: banana ?"

SERIES III. REACTOR S. FEB. 2, 1897.

1.	ab	30	r	"Grease, soap; not familiar."
2.	ba	33	w	"Ammonia."
3.	ba	36	r	"Camphor."
4.	ab	38	w	"Like turpentine."
5.	ab	41	w	"No particular odor; like an old medicine bottle."
6.	ab	43	r	"Burning stuff, disinfectant."
7.	ba	47	w	"Must be bitter almond."
8.	ba	29	r	"Lavender."
9.	ab	31	r	"Moth balls."
10.	ab	32	w	"Alcohol."
11.	ab	28	r	"Some chemical that I have smelled in a tin-type shop."
12.	ba	24	r	"Peppermint."
13.	ba	23	r	"Some chemical in gilding mixture; somewhat like orange blossom."
14.	ba	26	r	"Chloroform."
15.	ab	21	w	"Perfectly familiar; cannot name."
16.	ba	35	w	"Mint."
17.	ab	37	w	"Very familiar; like pine needles; out-of-door-like."
18.	ba	49	r	"Bitter almonds."
19.	ba	1	w	"Kitchen odor; vanilla ?"
20.	ab	3	w	"Delicious country smell; out-of-door odor."

SERIES IV. REACTOR P. MARCH 9, 1897.

1.	ab	1	w	"Some sort of spice."
2.	ab	2	r	"Wormwood."
3.	ba	3	w	"Pennyroyal."
4.	ba	4	r	"Faint, indefinite odor."
5.	ab	5	r	"Do not know."
6.	ab	6	r	"Orange."
7.	ab	7	w	"Knew it once."

8.	<i>ba</i>	41	<i>r</i>	"Chloride of lime."
9.	<i>ba</i>	50	<i>r</i>	"Wintergreen."
10.	<i>ba</i>	46	<i>r</i>	"Whiskey."
11.	<i>ab</i>	37	<i>r</i>	"Do not know; seems familiar."
12.	<i>ab</i>	49	<i>r</i>	"Almonds."
13.	<i>ab</i>	44	<i>r</i>	"Very faint."
14.	<i>ba</i>	48	<i>r</i>	"Cannot smell it."
15.	<i>ba</i>	47	<i>r</i>	"Almonds."
16.	<i>ba</i>	40	<i>w</i>	"Catnip."
17.	<i>ab</i>	42	<i>r</i>	"Sour paste."
18.	<i>ba</i>	43 no jdgt.	"Mustard."	
19.	<i>ab</i>	45	<i>w</i>	"Do not know; nose burnt."
20.	<i>ba</i>	35	<i>r</i>	"Peppermint."

The above *Remarks* are, in some cases, much condensed from the experimental records. But they show fairly well the material that one has upon which to base an induction as to why certain odors distracted and others did not. It is clear that the subjects show great individual differences in the matter of distraction. We should think, *a priori*, that an odor would distract when it was either (1) familiar, but not to be named, or (2) so familiar as to set up a vivid train of associated ideas. Series I. fits in with this assumption pretty well: the three *w* fall under the first heading, the *no jdgt.* under the second. At the same time there are several exceptions to the latter rubrie. On the whole, it seems fair to say that the reactor *O.* was most distracted by familiar smells which could not be named. The following introspective accounts are typical:

Rosemary.—"Did not know the scent. Little like tansy, but sweeter. Some kind of eau de cologne? Sweetish, and a little aromatic. Worried lest I should not know what the scent was by the time that the second ball fell. Think now that I could recognize it if I smelled again. Seemed unfamiliar, but a perfumery smell. When the ball fell I thought 'There, that is gone, and I do not know what it is.' No associated ideas. Feeling of annoyance that I could not tell what it was."

Absolute Alcohol.—"Seems to be chiefly alcohol. Something else in it, perhaps. Could not recognize it at once, though it seemed familiar. Thought of cinnamon, but it was not that. Scent of the perfume order. Just as ball fell thought, 'It's like weak alcohol.' Associations after the ball fell, not before."

Banana.—"Idea of beech nuts flashed up, but was not a decision. Strong and peculiar odor. Not like a perfume; lacking in delicacy and fragrance. Not like chemicals. Feeling of dissatisfaction at not recognizing it before the ball fell. Worried afterwards for a little; scent came back and seemed on the point of being grasped."

As an instance under the second heading we have this, *e. g.:*

Carbolic Acid.—"Prompt judgment both of balls and scent. Carbolic acid. Having recognized, was going to take another sniff when I thought: 'What's the use? You know that.' Just then the ball dropped." The judgment was a *w*.

The reactor *B.*, on the other hand, seems to have been

most distracted, not when he could not name a familiar smell, but when the smell was altogether unfamiliar. The attention in this case did not relax, as one might have expected,—perhaps owing to the shortness of the interval,—but played upon the unknown stimulus through the five seconds. *E.g.*:

Cinnamon.—“Hard to remember the balls after smelling. Had no idea what the smell was. No associations. Kept smelling all the time.”

Violet.—“Some perfume? No idea of the kind; but seems a good sort. Kept smelling. No associations.” Both judgments *w.*

The reactor *P.*, again, tended to let the distraction go, when he could not recognize the scent, and to concentrate his attention upon the coming sound. There was little if any sign of the ‘worry’ and ‘annoyance’ of the subject *O.* *P.*’s recognitions, right and wrong alike, were very quick; and the jerk of recognition appears to have distracted him more than the steady feeling of unfamiliarity.

The reactor *S.* showed a much greater tendency to association during the five seconds’ limit than any of the other three subjects. She was distracted by these as well as by the annoyance of inability to name. Thus tansy suggested sage tea, and that the giving of sage tea at the new moon. Pennyroyal suggested the mustiness of a certain old house; rosemary suggested a toilet table and also cooking in a kitchen; etc., etc. *S.* hardly ever found a scent wholly unfamiliar. *O.* stands next to her in this respect. *B.* and *P.* often ‘gave up’ the problem of recognition.

Putting all the facts together, one may say that a scent can distract: (1) when it is familiar, but cannot be named, and so ‘bothers’:

(2) when it is very familiar, and so suggests scenes and events readily:

(3) when it is totally unfamiliar, and so piques the attention; and

(4) when it is easily recognized, and so sets up a general feeling of relief that the trial is over.

There are very few *w* that cannot be accounted for on some one or other of these four principles; and what there are can be traced, almost without exception, to a slipping of the attention, due to tiredness, preoccupation, the unusual obstinacy of a cork, etc.

III. *Final Test Experiments.* At the conclusion of the whole inquiry 100 experiments were made upon each subject, without distraction, with the view of discovering any advance in practice. As was said above, practice had, unfortunately, advanced. The percentages of *r* cases before distraction were:

B.	O.	P.	S.
73.3	91	85	67.3 ;

after distraction they were :

80	96	94	76.
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The order of relative accuracy of discrimination is the same as before ; the absolute accuracy has increased for each subject. We can do nothing but confess that our preliminary work was cut too short, and that our final results are so far invalid.

What, now, are the final *results* of the whole investigation? How do the distraction percentages of r cases compare with the percentages when there was no distraction?

We have sought to answer this question in the following Table. To construct the Table we first averaged the per cent. of r without distraction from the practice experiments and the final tests ; thus obtaining

B.	O.	P.	S.
76.6	93.5	89.5	71.6

as our standard percentages. From these we subtracted the per cent. of r for each subject and for each of the fifty scents. The column headed 'per cent.' thus gives the *difference* between the per cent. of r without distraction and the per cent. of r with distraction by a particular scent. The scent is indicated by its number. The number of distraction-experiments from which the per cent. of r with distraction was calculated varied for the various subjects and scents. It is shown in the column headed 'No.' Thus, in the first line of the Table, the figures mean that for the reactor O . the scent 49 (nitro-wurtzite) was the most efficient distractor ; it was presented in 14 series ; and the percentage of r cases when it was used was no more than 93.5 minus 51.5, i. e., 42. And so on.

Remarks upon the Table. (1) It is clear that the Table is incomplete ; the column headed 'No.' shows uneven figures. We had hoped to have 20 series for each scent ; but of this time did not allow. Neither had we time for any control experiments, outside of and beyond the regularly arranged and varied experimental series. Lastly, it must be remembered that practice was changing during the experiments ; so that the order of the scents in distracting value may not be entirely correct. The practice effect, i. e., may have differed at different stages of the work ; and the form of the practice curve may be different for different odors.

REACTOR :	O.				B.				S.				P.			
	Distracting Value (highest to lowest).	Scent.	Per cent.	No. of Exper- iments.	Scent.	Per cent.	No. of Exper- iments.	Scent.	Per cent.	No. of Exper- iments.	Scent.	Per cent.	No. of Exper- iments.	Scent.	Per cent.	No. of Exper- iments.
1	49	51.5	14	45	56.3	19	16	52.3	14	38	56.5	6				
2	15	47.5	15	47	56.3	19	23	48.3	12	37	52.5	8				
3	39	43.5	14	33	54.3	17	34	48.3	12	14	47.5	7				
4	19	40.5	15	16	52.3	18	37	45.3	14	7	47.5	8				
5	25	37.5	16	48	51.3	15	2	45.3	14	22	46.5	7				
6	3	36.5	14	34	46.3	16	4	45.3	14	13	39.5	8				
7	35	35.5	17	9	46.3	19	14	45.3	14	40	39.5	8				
8	18	33.5	15	46	46.3	19	17	45.3	14	39	35.5	11				
9	28	33.5	15	24	44.3	18	21	45.3	13	45	34.5	9				
10	36	33.5	15	19	44.3	18	30	43.3	13	20	32.5	7				
11	1	32.5	13	30	44.3	15	15	43.3	13	21	32.5	7				
12	41	32.5	13	39	44.3	15	22	43.3	13	33	32.5	7				
13	43	32.5	13	10	42.3	20	39	43.3	12	41	32.5	7				
14	4	31.5	16	17	42.3	17	29	40.3	14	3	29.5	10				
15	44	31.5	16	29	42.3	20	19	40.3	14	4	29.5	10				
16	12	29.5	14	26	42.3	19	28	35.3	12	23	27.5	8				
17	2	27.5	15	35	42.3	20	35	35.3	13	27	27.5	8				
18	6	27.5	15	49	42.3	17	3	35.3	13	35	27.5	8				
19	21	27.5	15	50	40.3	16	5	35.3	13	31	23.5	9				
20	24	27.5	15	22	40.3	16	32	35.3	13	9	18.5	7				
21	26	27.5	18	28	39.3	19	44	35.3	14	25	18.5	7				
22	27	27.5	15	41	39.3	18	43	33.3	15	34	18.5	7				
23	13	25.5	16	43	36.3	17	8	33.3	13	42	18.5	7				
24	9	24.5	13	14	36.3	17	50	33.3	15	43	18.5	7				
25	22	24.5	13	31	36.3	20	42	31.3	13	50	18.5	6				
26	47	24.5	13	2	35.3	19	10	31.3	20	1	17.5	11				
27	14	22.5	14	11	35.3	19	13	31.3	14	11	14.5	8				
28	20	22.5	14	40	35.3	20	41	30.3	15	2	14.5	8				
29	48	21.5	11	32	35.3	17	27	30.3	14	10	14.5	8				
30	16	20.5	15	6	33.3	18	7	27.3	15	16	14.5	8				
31	17	20.5	15	21	30.3	19	31	27.3	13	26	14.5	8				
32	31	18.5	16	1	30.3	17	20	26.3	15	32	14.5	9				
33	23	15.5	14	3	30.3	19	1	23.3	14	49	14.5	7				
34	34	15.5	14	18	30.3	17	33	23.3	13	8	12.5	9				
35	37	13.5	17	23	30.3	19	25	23.3	12	24	6.5	6				
36	46	13.5	16	20	30.3	17	12	20.3	13	28	6.5	6				
37	5	13.5	15	12	30.3	19	45	20.3	15	48	6.5	6				
38	10	13.5	15	25	27.3	18	47	16.3	14	15	4.5	7				
39	29	13.5	15	37	27.3	20	49	16.3	14	30	4.5	7				
40	33	13.5	15	4	25.3	19	48	13.3	10	44	4.5	7				
41	32	12.5	15	44	24.3	15	38	12.3	13	47	4.5	7				
42	7	9.5	13	27	22.3	20	6	12.3	13	12	2.5	8				
43	38	9.5	15	8	22.3	18	26	10.3	11	29	2.5	8				
44	11	8.5	14	36	22.3	20	46	9.3	14	6	1.5	9				
45	45	8.5	13	7	21.3	16	9	9.3	14	17	1.5	9				
46	50	8.5	11	13	20.3	19	11	4.3	13	19	1.5	9				
47	8	7.5	15	5	19.3	17	36	4.3	13	36	1.5	9				
48	42	7.5	15	42	13.3	14	18	4.3	13	5	-10.5	10				
49	40	1.5	14	15	13.3	17	24	2.3	14	18	-10.5	8				
50	30	-6.5	15	38	10.3	20	40	-6	15	46	-10.5	7				

(2) It is clear that the different odors have very different distracting values, and that these values differ for the different subjects. Even with 50 scents, taken largely at hazard as they could be procured, we have a pretty continuous distraction series for each subject, the reduction of the r per cent. ranging from 50 to zero: indeed, in some cases the 'distraction' here, as in our previous work upon distractors, proves to be a stimulant, the subject working better under distraction than under standard conditions.

The mechanism of least distraction or of actual stimulation may be inferred, to some extent, from the introspective records. A few of these are given:

Reactor O., Olive Oil.—(1) Oil; like poor olive oil. (2), (3), (4), (5) Olive oil. (6) Oil. (7) Olive oil. (8) Sweet oil. (9)? Like molasses. (10) Olive oil. (11), (12) Oil. (13) Olive oil. (14), (15) Oil.

Reactor B., Oil of Turpentine.—(1), (2), (3), (4) Turpentine. (5) Cannot name. [This experiment came immediately after the giving of 'turpentine' as the scent of 33.] (6), (7) Turpentine. (8) Varnish. (9), (10), (11), (12), (13) Turpentine. (14) Vague. Had it on the tip of the tongue. [Turpentine had been given earlier in the series for 37.] (15) Know, but cannot name. [No previous turpentine judgment.] (16) Do not know. [Turpentine given earlier in the series for 37.] (17), (18), (19), (20) Turpentine.

Reactor S., Rosemary.—(1) Perfume. Suggests toilet and cooking. (2) Lemon verbena. (3) Perfectly familiar; like lemon. (4), (5) Lavender. (6) Lemon verbena. (7), (8) Lavender. (9) Lemon verbena. (10) Lavender? [Lavender had been given in the series immediately preceding this: hence the doubt.] (11) Lavender? [Same reason for doubt.] (12), (13) Lavender. (14) Sage tea. [Lavender judged in previous series.] (15) Balsam. [Lavender given for 20, a few experiments before.]

Reactor P., Absolute Alcohol.—(1) Odor familiar. Thought of aconite and fever. (2) Do not know; little smell. (3) Do not know. (4) Like cold potato skins. (5) Do not know; sweet. (6) Whiskey. (7) Sweet and sickish.

Oil of Bergamot.—(1) Citron? No; probably heliotrope. (2) Do not know. (3) Orange. (4) No name. (5) Lemon. (6) Perfume. (7) Lemon? (8) Orange.

Oil of Spike.—(1) Familiar; no name. (2) Cannot grasp odor. (3) Faint; do not know. (4) White lead. (5), (6) Unknown. (7) Orange. (8), (9) Unknown. (10) Crude petroleum.

We notice here at once the difference of attitude to the distraction taken up by O., B. and S., on the one hand, and P., on the other (cf. the qualitative analysis of distraction above). On the whole, it would seem that least distraction or stimulation means for the first three subjects not so much a dynamogenic effect of stimuli, an actual heightening of the attention, as the reaction of relief upon a quite familiar stimulus; the distraction is put away, and the attention reverts to the sounds. This principle crosses the second distraction-

principle to some extent. We must suppose either that there are here few associates, despite familiarity ; or (what is more likely) that the attention was tending, as things were, rather to the sound than to the scent, and so slipped easily to the sound after recognition was accomplished. In this latter case, the second distraction-principle would hold only providing that the experiment is accurately made, *i. e.*, that the full strain of attention is on the familiar scent. How difficult of attainment this accuracy is, all who have worked at the distraction-problem will know.

P. was distracted when he recognized (fourth principle); the feeling of relief took his attention not only from the scent, but from the whole experiment. In his case, least distraction or stimulation does appear to mean a heightening of the attention ; his *r* per cent. is maximal when he cannot get the smell, when it eludes him, when he can associate to it only a name that he is pretty sure is not correct. (We have found evidence of this principle in our previous work.) *P.*'s tendency was to let the distraction go if he could not recognize the smell at all, but in these instances there seems to have been a feeling that he 'ought' to know the scent.¹

Summary. The Study is incomplete. Not enough series were taken ; not enough practice was had ; no control experiments were made.

In spite of this, it seems from the experimental results that odor series offer a means of distraction of the attention that is uniform, capable of gradation, and applicable to normal subjects. Fifty scents, used for distracting judgments of sound intensity, lowered the *r* per cent. by an amount ranging from fifty to zero : in some instances the lowering passed beyond zero and became an increase.

Individual differences showed themselves, but do not affect the above general statement. We infer from the results that distraction can be set up in four ways : by familiar scents that cannot be named ; by very familiar and therefore suggestive scents (attention on the scent); by unfamiliar and therefore puzzling scents ; and by easily recognizable scents, whose recognition suggests that the whole experiment is over (attention tending away from the experiment). Least distraction or stimulation can be set up in two ways : by very familiar scents (attention on the sound), and by uncertainly

¹ We may just note the fact that the four subjects showed marked differences as regards the way in which the first sound was *memorised* and the judgment of likeness or difference of intensity reached. It was not our object to examine these differences in the present connection.

familiar scents (attention tending away from the experiment, and now held upon it).

It appears that the question of distraction by odors would well repay systematic work, continued for two or three years, and carried over into other departments of intensive discrimination.

XV.—THE PROJECTION OF THE RETINAL IMAGE.

BY W. B. PILLSBURY, PH. D.

It would seem that the extended discussion of the problem of the "Inversion of the Retinal Image," carried on in the *Psychological Review* for the current year, would leave nothing to be said on the above question. One bit of experimental evidence has been overlooked, however, which may be of value in settling disputed points in both of the intimately connected problems. As the discussion stands at present, Professor Stratton has shown that, when the field of vision is inverted by means of lenses, it is possible in a comparatively brief time so to adjust the tactal space to the new visual space that no errors in movement result, and there is no conscious disparity between the two spaces. Professor Hyslop rejoins that this is 'off the point,' because the experiments only cover the question of adapting movements to visual space, which is very different from the question of reference within the visual space itself; and, that, first of all, we must prove that inverted vision is an anomaly. On the constructive side, Professor Hyslop maintains that it is the general law, and therefore natural, that all impressions on the retina should be referred backward along a line perpendicular to that surface, just as in touch we 'feel' with the end of a stick in a line perpendicular to the surface of the skin.

It is with this law that our own observations primarily deal. Professor Gage of Cornell University called our attention to the fact that in using the Abbé *camera lucida*, in drawing from the microscope, the double image was invariably referred to the drawing board, not to the stage of the microscope. In view of the fact that the latter is in the line perpendicular to the retina, or is in the projection of the unbent ray, we seem here to be dealing with an anomaly of vision, and one worthy of careful investigation. Owing to the construction of the instrument the ray from the paper on the

drawing-board is reflected twice before it reaches the eye : once from a mirror above the board, and once from a silvered prism above the ocular of the microscope. The ray from the slide under the objective, on the other hand, passes in a straight line through an opening in the silvering of the prism ; so that the rays from drawing-board and slide enter the eye along the same line, and occupy a common position upon the retina.

Here we have a practical test of the comparative truth of the projection or nativistic and the empirical theories. The eye is offered a choice between two possible lines of reference, the one of which it must take if the projection theory be true, and the other of which it may take if the empirical view be correct. It would not be necessary that both images should be referred to the drawing-board, if we assume the empirical standpoint. Even on this theory we are opposing the experience of the individual and the race, that objects can be touched somewhere in the line perpendicular to the retina at the point of stimulation, to the present knowledge that we can touch the paper by the side of the microscope. This latter knowledge, furthermore, is not unambiguous, because we have had fully as many tactful indications that the preparation is under the objective of the microscope as that the paper is on the drawing-board to one side. Particularly is this the case if, as is true most frequently, the student is accustomed to the use of the microscope and unfamiliar with the *camera lucida*. Every circumstance, then, favors the expectation that the double image will be referred to the stage of the microscope, except the fact that we expect to draw the image upon the paper, and are intent upon seeing it against the white back-ground under the point of our pencil.

In spite of the predominance of theoretical considerations in favor of the direct line, the fact is that in every instance the combined image is referred to the drawing-board. Professor Gage assures me that he has never known an exception to this rule in all his experience with classes in microscopy in Cornell University, which have been composed in the aggregate of many hundred students. We made a number of experiments, when at an early stage in the use of the *camera lucida*, with the mirror in different positions ; and found that always, when an object of known position was recognized, it was referred to its true place ; before it was recognized it was referred to the stage of the microscope. Once, by accident, the black metal surface of the back of the mirror was turned toward the tube, in a position to reflect the ceiling of the room ; and even this dark, indistinct image was assigned to its proper place as soon as it was recognized. This observation was made after only two hours' work with the *camera*

lucida two days before. It must be noted that in all these cases the objects in the mirror were being constantly changed, while the field of the microscope was not varied. Interest and attention were, therefore, directed almost entirely to the kaleidoscopic panorama of the former, just as in the usual case they were directed to the image that was to be drawn. It would seem, then, that this phenomenon is very closely related to retinal rivalry; and that the images are referred to the place we are most interested in at the moment. This means that our knowledge that an object occupies a certain position is practically as strong in producing reference to a point out of the normal line of projection as to a point in that normal line; or that *the direction of the ray which gives rise to a retinal stimulation is comparatively unimportant in determining the place in space to which we shall attribute the origin of the stimulation.*

These observations alone would be decisive against the projection theory in any of its forms. The rashest nativist would not care to assume that the retina reacts differently to light that has been reflected and to light that has not been reflected, or that we can know how many and of what magnitude are the angles that the path of the ether vibrations has described in its course to the eye. And this hypothesis is also excluded in our experiments by the fact that the bent ray is preferred to the direct ray.

We have, then, met Professor Hyslop's¹ first and second conditions: that we should prove that inverted vision or projection outward in a line perpendicular to the retina is not natural, or is not the only natural method of reference; and that the proof should be in terms of vision alone. We may now consider his objection to the empirical theory that it assumes a knowledge of the visual impression, both before and after reference outward. This is, of course, a mere figure of speech, which is employed for convenience by both sides. It is no more to be taken literally than Professor Hyslop would care to have a critic work out his conception of nature and natural law from the sentence:² "Now accepting Mr. Spener's conclusion that the sense of touch was the original germ out of which all the senses were developed, among them sight, we can readily see that nature had only to give the retina a curved form, circular, elliptical or parabolic, in order to adjust the law of 'eccentric projection' to the modified conditions of vision involving refraction of light and inverted images." No one of normal development can

¹ *Psy. Rev.*, IV, 2, p. 151.

² *Psy. Rev.*, IV, 2, p. 160.

remember a time when reference to a point in space did not take place, or a time when the images were referred to the retina; because reference to the retina involves knowledge or experience in space just as much as reference to a point remote from the body. The facts are apparent to all; but it is very difficult to represent them or discuss them without falling into figures of speech. Professor Hyslop himself does not escape the danger.

We have, then, no course left but to accept the empirical theory; for the 'eye-movement theory' has never been held by anyone to be a sufficient explanation in itself, and has also been disproven by both Professor Stratton and Professor Hyslop.

The empirical theory seems the more applicable to direction, because there is no function of the eye that in any way corresponds to this attribute. The reaction of the retina and of the ciliary muscle is the same, no matter from what direction the exciting stimulus may come. We are, then, compelled to look to some sense besides vision to supply the deficiency; and touch, the other spatial sense, seems the most natural recourse.

The question from this point on is the question of the genesis of space perception; and within the limits of a paper of this kind it is only possible to remark that all evidence points to the conclusion that space is a composite, and that in the normal consciousness more than one sense must always be at work in its development. We therefore conclude with Professor Stratton that the phenomena of projection can only be explained empirically by calling to our aid the sense of touch.

POSTSCRIPT.—(1) It should be stated, in connection with Dr. Pillsbury's explanation of the lateral projection of the image when Abbé's *camera lucida* is placed over the ocular of the microscope, that the Cornell students pass to the use of the Abbé instrument by way of the Wollaston *camera lucida*. Hence they may come to the former with a predisposition which is too strong to be broken by their new-gained knowledge of its construction and dioptrical properties.

(2) After reading Dr. Pillsbury's paper, it occurred to Professor Gage that it would be well to repeat the observations on the Abbé camera. He found that—although in the whole course of his previous experience he had localised the preparation on the drawing-board—he was now able at will to see it either there or in the microscope. Professor Gage came to the Abbé by way of the Wollaston instrument. Again: he has found two persons who are at present unable to localise the preparation elsewhere than in the microscope.

The one is wholly unpracticed in the use of the microscope ; the other is a practiced microscopist, who did not, however, use the Wollaston until after he had used the Abbé instrument. My own experience (by no means extended) is as follows : I have never used the Wollaston camera ; but I invariably localised the preparation on the drawing-board during a short time in which I was working with the Abbé camera. My first observations were taken without, the later ones with, theoretical knowledge of the instrument. Now, on making observations with Professor Gage, I find that I am able, as he is, to see the object with either location.

It seems, both to Professor Gage and to myself, that this criss-cross of evidence and experience tells strongly in favor of Dr. Pillsbury's main contention : that localisation demands an empiristic explanation.

E. B. T.

NOTE TO STUDIES IV AND VII.

To their work upon the quantitative determination of the dotted-line and point-distance illusion (this JOURNAL, Vol. VI) Messrs. Knox and Watanabe appended certain theoretical remarks. Two of these run as follows :

(1) Since our judgment of vertical distances is in general less accurate than our judgment of horizontal, we should expect to find a higher value of Δ in the former case than in the latter.

(2) Binocular bisection of horizontal distances is not subject to any constant error; binocular bisection of verticals is subject to the constant error of overestimation of the upper part of the field of vision. We should, therefore, expect to find the *m. v.* of our vertical Δ 's greater than that of our horizontal.

These two remarks were very sharply criticised by Professor Heymans in the *Zeitsch. f. Psych.*, Vol. X, p. 465. As the criticism seemed to depend upon a misunderstanding (for which the brevity of the remarks themselves might be largely responsible), I published a full explanation in the *Zeitsch.*, Vol. XII, pp. 395, 396. By "less accurate" in (1) we had meant to indicate that the difference-limen is greater in judgments of verticals. The reasoning underlying (2) is somewhat complicated, and need not be repeated here.

Professor Heymans has replied to the first part of this explanation in the *Zeitsch.*, Vol. XIII, p. 474. In his reply he has entirely overlooked the fact that the upper and lower difference-limina must be of different magnitude if Weber's law holds, *i. e.*, unless the absolute sensible discrimination is constant. The estimation-difference J follows the same law as the sensible discrimination. I still think, therefore, that our first remark is justified. On the second point Professor Heymans offers no further criticism.

E. B. T.

DISCUSSION.

COLOR PERCEPTION OF CHILDREN.

The following brief notes may be made in reply to Miss Schallenberger's strictures upon my Chapter on "Distance and Color Perception by Infants" (Chapter III of "Mental Development"):

(1) As to the allusions to Preyer's method, she will find reference to some notes sent me by Professor Preyer himself incorporated in the German (Reuther u. Reichard, Berlin), and French (Alcan, Paris) translations, which are both to appear about the time of this. I regret that the second English edition should have been reprinted without these and other revisions referred to below; but the publishers neglected to inform me that the chance had offered itself. In either of the foreign editions may also be found such changes of interpretation (very slight) as I now find it well to make.

(2) The mistakes (seven in number) which Miss Schallenberger finds in my Tables I and II are all, except one, "read in" mistakes, *i. e.*, "read in" by the carrying out of decimals, a quite unnecessary proceeding in a matter where only differences of first and (sometimes) second place figures are of any value. The nearest approach to a mistake is the reading .90 for .882. I carried the decimals to the third place for the first three colors simply for fullness, not for any "discovery" thereby. The one real error (16 for 15) is a typographical mistake; it is correct in the first edition. It is also correct in the foreign editions.

(3) As to inconsistencies between the text and the tables, that is due to the fact which I mentioned in the preface to the second edition: an accidental substitution of columns; Miss Schallenberger explains it correctly. In the second edition certain statements (only one of any moment) were noted for correction, and would have been corrected when the second edition was reprinted, if I had been given the chance.

(4) I shall look up the suggestions as to Lehmann, etc., and accept the corrections gratefully where I am wrong.

Miss Schallenberger's criticisms are, in the main, however, below the threshold of my intention; seeing that I distinctly disclaimed much independent value for the figures given, the number of the experiments being too small. I published the results mainly for their illustrative value.

I have before advised experimental purists to "first catch" a live, warm baby, and attempt to work it; my present critic shows that she does not know the difficulties of the task at first hand. While thanking her, therefore, for her minute examination of the chapter and promising to reconsider the points if I get the chance of a future edition, I yet fear that another revision would leave the matter still very unsatisfactory from a hypercritical point of view.

J. MARK BALDWIN.

Princeton, Aug. 13.

Professor Baldwin's notes are most encouraging. It is encouraging, in the first place, to read so frank an admission of error on the few points which have been singled out of my criticism for present comment. If the chance for future revision does come, I believe that Professor Baldwin will find such admission equally necessary on the more serious points of which he now says nothing. It is encouraging, in the second place, to find my general opinion of the value of the experimental work of this chapter confirmed by the author's own statements. If figures are printed not because they mean anything, but "simply for fullness" (!), it is time that criticism should begin. And if the fact that experiments are published "mainly for their illustrative value" can be seriously put forward as an excuse for great experimental inaccuracy, it is time for someone to point out that mere profession will not work in science any more than in conduct; a man shall not be saved by the very best of intentions.

As to Professor Baldwin's concluding remarks, I really cannot see that the investigation of any baby, of whatever sort its 'vital differences' and whatever grade its temperature, is furthered by inaccuracy of observation and record on the part of the investigating parent.

M. SCHALLENBERGER.

Stanford University.

A MUSICAL EXPERIMENT.

BY JUNE E. DOWNEY,
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The following report is submitted as a postscript, as it were, to the articles on "Musical Expressiveness," found in Vols. IV and V of this JOURNAL. The experiment was modeled after the one there given, with a few unimportant variations. Six selections of music were interpreted. After each of these an interval was allowed for the listeners to write down the impressions received from the music. No questions were asked on the selections, nor were the titles or composers of the selections given. Twenty-two persons were present at the recital. Answers from all were not received for each selection. Only one of the twenty-two, namely (21), was a professional musician. The remaining twenty-one persons had either no musical training whatever, or but comparatively little. With one or two exceptions all were fond of music.

The programme was intentionally made short, the whole experiment lasting not more than an hour and a half. The selections were lettered A, B, C, D, E and F. The answers to each are numbered to twenty-two. The first seven are returned by gentlemen, the remaining fifteen by ladies. The piano-forte was the only instrument used; there were three performers. The experiment was under the direction of Prof. E. E. Slossen (University of Wyoming) and Misses A. H. Talbot and J. E. Downey. The names of the selections and answers returned follow:

A. *Chopin, Funeral March (Sonata, Op. 35)*. 1. First sensation, that it was one of Mrs. Caudle's curtain lectures, interspersed with soliloquies over her own hard lot. Later concluded it represented a tired father walking the floor at midnight with a cross, crying baby, and alternately singing Watts' "Cradle Hymn" and scolding the baby. 2. Funeral of a soldier. 3. I was affected as I would have been had I read a strong, spirited poem. In fact, the first distinct impression was of some sweet poem of Scott; not military, but peaceful. 4. Grief, mourning, swelling to a climax. Reaction. Hope, faith, doubt alternate. 5. A country scene. Old orchard, tremendous trees, blossom-fragrant air. A breeze stirs the boughs. Rain begins to fall, first in large drops, then in rhythmic sheets, driven by gusts of wind. Thunder is followed by increased downpour. The sun breaks through the clouds. Sun-shower; the reverberations of the summer-shower roll across the distant hills. 6. Funeral procession of Abraham Lincoln. 7. Sadness. An unsuccessful but constantly renewed attempt to throw off the burden of sorrow. 8. A life of possibly more than usual melancholy with ray of hope and happiness brought in unwelcomely; or the hope of something unexpected coming without recognition. A slight recognition of the ideal without overcoming the natural or acquired

melancholy. 9. Either a storm at sea, or a battle. 10. My thoughts were of the composer. At the beginning it suggested a storm at sea, then, at times, music on the water, or in the distance. The interpretation does not interest me so much as the harmony of tones. 11. A death and the heavy sorrowing of friends, a sorrow too deep for tears, which soon finds relief in tears. This changes to a feeling of loneliness and resignation which is beautiful. It is the covering of a sorrowful heart with a smile. The repetition of the first part is the rekindling of the sorrow which finally brings the person to an extremely morbid state. 12. Saw a moon-lighted garden surrounding an ancient castle. A band of monks was marching to their church in the distance, where the organ was softly playing. A mother was pleading with her son not to join them. After much pleading on her part and grumbling answers on his, he still insists on his own way. 13. My impression was of passing a church and of hearing the organ; then of passing into the woods, and hearing a storm; then of walking by the side of a stream which at first seemed but a brook, but which grew in size, yet ever sang a sweet song, sad at times, the stream flowing on and on, and emptying into a river just where the trees met. 14. A calm, clear, sunny afternoon with pleasing landscape. A traveler is lying on the greensward and reveling in the quiet scene. But soon clouds roll up, and thunder, dark, growling at first, then angry. There comes a shower, after which reappears the peaceful, sunny scene. Night falls. A few angry peals of thunder, a few flashes of lightning come, and rain threatens, but does not fall. 15. The first part of the selection brought to my mind a funeral train. I believe I could quite see the picture. The line of march must have been miles in length. Then comes a storm, and the rest is indistinct. 16. This impressed me as a descriptive piece. It described a feeling of resignation over a death, and the sorrow went as an undertone through the entire piece, toning down any other violent feelings. It presented a distinct feeling that might easily have been put into a picture. 17. A wail of a lost spirit. 18. Sadness. Death. It called to my mind memories of a dear friend who died years ago. 19. A double picture. Something deep and solemn and ominous, like the distant roar of a rising sea. Then a group of women talking, sometimes singing, but always listening. Occasionally the sea drowned the sound of their voices, then is quiet again. In the end there is a flood of lightning and a louder roar, then silence. 20. Known. Chopin's Funeral March. To me it represents the funeral of a soldier. First and third the march to and from a cathedral. The trio between represents the singing in cathedral and the organ-strains which accompany the burial service. 21—. 22. Deep, hopeless sorrow for someone lost. A prayer for help. The answer to the prayer. Hope and courage given.

B. S. F. Powell, *Nocturne, Hope* (*Op. 4, No. 1*). 1. Expression of the exuberant. Impulsive spirit of children at play. 2. No impression, unless it was the wind rustling through leaves. 3. I seem to have heard the piece at sometime previous. My mind occupied in finding where and by whom. Cannot recall, but impression evidently pleasurable. 4. This situation seems retrospective. A narrative of younger experience. 5. No defined impression save of singing maid with hope in her thought, shadow of possible ill and certainty of present happiness. 6. No impression. Called up no image. 7. Quiet enjoyment. Under a tree in the woods with no duty waiting to be done. 8. Suppressed joy. A dance of the fairies or of a sunbeam. 9. Sentiment, youth,

hope, Spring, happiness. 10. First part meditation, then pleading. 11. A perfectly happy life with a vein of sadness here and there, which comes of a thoughtful disposition. There is also a hopeful feeling mingled with the sadness. 12. Known. A happy, hopeful song. 13. My impression was of water flowing over pebbles, singing a gay little song, then of flowing over a wheel and singing a promise of future calmness and happiness. 14. Just a happy heart, full of sunshine; but afterwards a doubt, a shadow obscures the sky a little. 15. A restful sensation, but no impression. 16. It reminds me of a person whom I know whose chief characteristic is a happy shallowness. No serious view of life. The picture of the person came surrounded by various unfavorable circumstances. Do not care for this style of music. Not impressed by it. 17. No impression. 18. Organ voluntary in a large cathedral. (Selection not recalled, but probably a memory association.) 19. Doubt, uncertainty, indecision. A character, a girl, with varying moods. Moonlight flitting over tree-tops, or sunlight playing upon a shaded spot. 20. Known. Hope. First, blue sky with a few white, fleecy clouds on horizon; green trees. Secondly, nest of young birds. Thirdly, silence, save for sound of a distant babbling brook.

C. S. F. Powell, *Nocturne, Solitude* (*Op. 3, No. 2*). 1. Conveyed the idea of a political or theological argument or discussion. 2. No impression. 3. It seemed to me that I saw a man (or woman) in a crowded portion of a metropolis. Then I saw a stream flowing full and clear through a cool grove of magnificent trees. The impression of unrest and great longing seemed to be conveyed. 4. This may be an invocation, an address, though I cannot say positively that it leaves any definable impression upon me. 5. Tea-party. Chinese lanterns emerging from the trees. Lovely scene. 6. No impression. 7. No expression of emotion for me. 8—. 9. Memory reminded me of piano practice. 10. Thought all the time of the harmony of tone. No particular impression except of the running from one key to another. 11. An old man looking back on his life with a feeling of pride and of sorrow. Although he knows that he soon must die, yet he clings to life, "as a drowning man will clutch a straw." 12. Simply a song with a note of anxiety. 13. Impressions not definite. 14. No impression. 15. Water running over stones. 16. This gave me an uncomfortable confused feeling. I saw a picture of a storm on water with the patches of blue sky through the clouds. I felt annoyed at the confusion which it seemed to express. The picture was secondary. 17. No impression. 18. No impression. 19. A reverie of mingled regret and resignation. Something given up or something gained—which is the dearer? 20. Known. *Solitude*. Same background as in former selection. Blue sky and green trees, but a woman enters. A mother's anxiety for her child.

D. Händel's *Aria, opening bars, "He was despised and rejected of men," from the Messiah*. 1. Don't recognize it. Should think it was calculated to inspire religious and devotional feeling. 2. Devotional music. 3. No distinct impressions other than those of memory. I thought of churches. 4. This seems an invocation, importing praise, or perhaps repentance. 5. Hymn, expressing confidence in a state of future blessedness. Collection plate is being passed around. 6. No impression. 7. Known. Devotional. All sorrow, unrest, and trouble merged into peace. Chaos becomes Nirvana. 8. Don't recognize it. A cathedral; contrite heart bowed in prayer. 9. Devotional music. Reverential, inviting contrition. 10. Very familiar; can't recall name. Sacred song.

Suggests prayer. 11. A prayer. Church music. 12. Gave me the impression of church music. First few chords and the last most impressive. 13. Thought of my childhood, the love and tenderness of my mother. First part of strain gave the impression. 14. A sinful soul repentant and begging for mercy, then joyful because salvation seems near. 15. Presbyterian church choir. 16. This music heard at some Episcopal service, I think as an offertory solo. It suggested the taking of the collection. 17. Life no good. Hope. Despair. 18. Methodist church choir. 19. Known. A gust, overwhelming. Complaint of sorrow. 20. Händel's Aria—"He was despised and rejected of men." Seems to express self-renunciation and spiritual consolation, alternating with deep dejection and physical languor. Ends in a strain of faith. 21. A selection by Händel, which inspires religious feeling; a bright, encouraging strain is heard through the piece.

E. Chopin, *Nocturne (Op. 15)*. 1. Rather exhilarating and inspiring. Inclines one to want to dance. 2. A merry party attending a dance. 3. My impression was that the composer was going through some miserable affair of life. The lighter shades were hopeful. 4. An impression of life and action, rising and falling. Perhaps passion. 5. Sick-room. Patient very low. Doctor calls. Friends weep. Hope gone. Sick man makes great effort. Rises in bed, saying, "I ain't dead yet." Great joy. 6. No impression. 7. Quiet enjoyment. A merry mood, but kept within the limits of rational and innocent joy. 8. Conglomeration (Oolite). 9. Sentiment patriotic. Emotions, haste, energy, enthusiasm, unity. Memory, Fourth of July. 10. Thought it by Chopin. Irrepressible child, first here, then there, and nowhere in particular. Very suggestive of Chopin. 11. Someone seemed trying to be bright and cheerful, while all the time a strain of sadness was running through the life. 13. The impression produced was that of a party of friends who had gathered together to bid farewell to one of their number. They endeavor to be gay and happy, but there is a consciousness of sadness even in the midst of their pleasure. 14. Circus. Three rings. Interval. Then child rope-walker. Everyone breathless until he is through. 15. It brought to my mind the theatre where I had heard it or something similar. 16. I think the music probably described water in some form. My thought rather of the execution. 17. "I call earth not gray, but rosy." Joy. 18. Wind blowing through the trees. 19. A woman sitting in a moonlit garden. She is quiet and calm, but cannot quite lend her mind to the enjoyment of the beautiful night. Something troubles her and once wholly shuts out her surroundings, then by an unusual effort she forgets everything but the peace and serenity of the night and half dreams and dozes. 20. Love song. Sequence of emotions, tenderness, passion, solicitude, rivalry, ending with anxious tenderness and uncertainty by no means hopeless. 21. A nocturne by Chopin, which begins with a religious sentiment and becomes more intensified. Afterwards a feeling of repose or giving up of hope, ending with a peaceful thought to be resigned to fate.

F. Schubert-Liszt Serenade. 1. Sounds very natural. Like a lot of ladies all talking at once. Not one listening to what another is saying. 2. No impression. 3. (a) Feeling of happiness, (b) children at play, (c) home scenes, (d) earnestness, (e) desire, (f) yearning. The selection gave me a pleasant and joyous feeling. 4. Merely an impulse to make a noise. 5. Trout fishing. Big fish on hook. Takes both hands to hold him. Large sand fly lights on fisher's nose. Reel sings. He pulls him toward shore. Can see fins of fish in water. Steps on round stone. Falls down, loses fish.

Breaks pole. All the fish in basket get away. 6. No impression. 7. Fun and frolic. 8. Dancing and joy. 9. Sentiment, gaiety. Waltz at first. 10. Something light and dainty. Suggested pleasure and happiness. Nothing sad or religious. 11. An ideal Spring morning, when the birds are chirpy and building their nests, the flowers are blossoming, the air is fresh and fragrant. 12. Impression was vague. Birds twittering in the trees. 13. My impression was of an opera house, brightly lighted, the orchestra playing, people entering and exchanging courtesies. 14. Everybody happy. Clear skies. Tally-ho starting off. 15. No impression. 16. Simply enjoyed it. Think it a French selection. 17. Dancing, good company. 18. Happiness. A gay party of young people enjoying a frolic. 19. Known. Distinct associations. 20. Moonlight in Spain. Some light and passing emotion expressed. 21. "Hark, hark, the lark."—Shakespeare. By Schubert-Liszt. I know this composition, which expresses the singing of birds to me. It is bright and happy. 22. Twittering of birds.

We shall next proceed to analyze the music and the impressions produced:

A. *Chopin's Funeral March*. Twenty-one answers were received. The music is analyzed as dull grief and despair giving way to consolation in the trio, with a final return to the original mood. Of the twenty-one papers received, eight record an impression of death or its accompaniments, as follows: (2) funeral of a soldier; (6) funeral procession of Abraham Lincoln; (11) a death and the heavy sorrowing of friends; (15) first part of selection brought to mind a funeral train; (16) death, memories of a dead friend; (20) funeral of a soldier; (22) deep, hopeless sorrow for some one lost.

The analysis of the music, however, gives an emotional sequence, deep grief, hope, return to grief. This sequence is distinctly found in (11) a sorrow for death, too deep for tears, tears come and resignation, return to the sorrow with morbidness; also in (4) grief, mourning, swelling to a climax, reaction; hope, faith, doubt alternate. The elements of sorrow and hope are recognized in (16) death and resignation; (22) deep sorrow for one dead, prayer for help, answer to the prayer, hope and courage given; (7) sadness, an unsuccessful but constantly renewed attempt to throw off the burden of sorrow; (8) a life of melancholy, ray of hope unrecognized; (19) a double picture, something deep and solemn and ominous, the talking and singing of women.

In the eight papers remaining are recorded impressions of less emotional intensity, and of somewhat different imagery. (5), (9), (10), (13), (14), receive impressions of storms. (19) Also contained a storm element. In (5) the light-shade sequence is reversed, clear sky, clouds, passing of storm. (13) records a peaceful issue of storm. (14) gives passing of storm, but threats of rain remain; (12) gives a march of monks, a mother's pleading with her son not to join them, and failure of the pleading. In (1) alternate elements are recognized, weariness, singing of hymns, scolding. (3) alone recognizes no disquieting element in the music. The impression is of sweetness and peace.

It will be seen that twenty find some element of emotional unrest or sorrow in the music; for thirteen of the twenty the sorrow is intense. Eleven or twelve find a shading from dark to light in the impressions. For one alone is it all bright. Conclusion.—The music expresses some disquieting emotion of considerable intensity. There is found in it shading quite easily recognizable. No uniformity in the imagery.

B. S. F. Powell, Nocturne, Hope. Twenty answers were received. Of these (6) and (17) record no impression. Four only explicitly recognize the element of hope; (5) singing maid with hope; (9) youth, hope, Spring, happiness; (11) a hopeful feeling; (12) known, a happy, hopeful song. To these may be added (7) quiet enjoyment; (8) suppressed joy; (13) brook, gay little song, promise of calmness and happiness; (14) happy heart full of sunshine; (16) a happy, shallow nature, laughter; (20) imagery expressive of peaceful, hopeful happiness.

Two find the music expressive of childhood, (1) exuberant spirit of children at play; (4) retrospection, younger experience. For two the content is vague, (3) impression pleasurable; (15) restful sensation. Four impressions are wholly individual, (2) wind rustling through the leaves; (10) meditation, pleading; (18) organ voluntary; (19) doubt, uncertainty, indecision. Three find a shadow with joy, (5) shadow of possible ill, with certainty of present happiness; (11) happy life, but vein of sadness; (14) happy heart, but a doubt enters it. *Conclusion.*—At most the music expressed some emotion of vague happiness, with a vein of uncertainty in the conception.

C. S. F. Powell, Nocturne, Solitude. Nineteen answers were received, but (2), (6), (14), (17), (18) record no impression, and (7) finds no emotional interest. For (13) the impression is indefinite; (9) memory of piano practice; (10) thought of tone-harmony. Only ten papers remain, and of these two only give definitely the supposed emotion; (12) song with note of anxiety; (20) known, mother's anxiety for her child. The uneasy note is touched by (3) impression of unrest and great longing, and by (16) confused uncomfortable feeling, storm on water, patches of blue sky through the clouds. To these we may add (19) reverie of mingled regret and resignation; (11) old man looking back on life with feeling of pride and sorrow; (1) political or theological discussion. Of the two remaining (15) is indefinite, running water over stones; (5) contains imagery expressive of sentiment of gaiety—a tea-party. *Conclusion.*—The emotional content neither strong nor definite.

D. Händel's Aria: “*He was despised and rejected of men.*” Twenty-one answers are received, but (6) receives no impression. The bars given have been supposed to convey deep sorrow, even dejection; the musician attempted to give drooping effect of physical languor alternating with spiritual devotion. The attempt was wholly unsuccessful. Those to whom the selection was familiar found somewhat of the supposed emotional burden: (7) known, devotional; sorrow, unrest, trouble merged into peace; (19) known, gust, overwhelming, sorrow; (21) known, inspires religious feeling, bright, encouraging strain through the piece. How much the music contributed to the effect, and how much the words, is indeterminable. (20) had seen the analysis, and should not be included. Sixteen impressions remain to be considered. Of these thirteen find the music devotional, with emphasis upon different aspects of devotion. It is merely devotional to (1), (2), (3), (12), (15), (16), (18). Further elements are to be found in (4) invocation, importing praise, perhaps repentance; (5) hymn, expressing confidence in state of future blessedness; (8) contrite heart bowed in prayer; (9) reverential, inviting contrition; (10) prayer; (14) sinful soul, repentant, begging for mercy, then joy, salvation near. Akin to the emotion supposed to be in the selection is (17), life no good, hope, despair. For (13) comes thought of childhood, mother's love and tenderness, first part giving the impression. *Conclusion.*—The music is not inherently sad, but arouses a feeling of religious devotion, which takes individual form.

E. Nocturne of Chopin. Twenty-one answers. No impression for (6), while (15) finds associational impression. In the nineteen answers remaining the impressions are divided between those of activity more or less joyous, and those of peace and serenity, sad or joyous. Grouping, we place under the head of joyous activity: (1) rather exhilarating and inspiring, inclination to dance; (2) merry party attending a dance; (4) impression of life and action, perhaps passion; (9) patriotic sentiment, haste, energy, enthusiasm, unity; and (10) irrepressible child. Under quiet happiness group (7) quiet enjoyment, (11) quiet beauty, someone gazing on stars among mountains; (17) "I call earth not gray, but rosy." Mingling of sadness with the joy: (5) sickness, despair, hope; (12) attempt to be bright and cheerful, strain of sadness; (13) party of friends bidding farewell to one of their number, gay appearance, consciousness of sadness; (14) circus, child rope-walker, breathless suspense; (19) woman in garden, quiet beauty, but a thought troubles; (3) miserable affair of life, but hopeful shades: (20) love-song, sequence of emotions, tenderness, passion, solicitude, rivalry; (21) religious sentiment, repose, giving up of hope, resignation. There is indefiniteness: in (8) conglomerate, in (16) water in some form, and in (18) wind blowing through trees, probably expressive of not unpleasant activity. Sixteen find some element of happiness or hope. Five find distinct expression of activity. Three report that an impression of serenity is given. Eight find a note of sadness. Conclusion.—Probably the music expressed some sort of happiness or joy or hope with a subdued strain of sadness. Joy dominant, sadness subordinate.

F. Schubert-Liszt, Serenade. Twenty-two answers. No impression from (2), (15), (16). The selection is recognized by (19) and has distinct associations. (4) finds it merely an impulse to make a noise, and (16) simply enjoyed it. Under impressions of joyful emotion or imagery we group (3) pleasant or joyous feeling; (7) fun or frolic; (8) dancing and joy; (9) sentiment of gaiety; (10) pleasure and happiness; (11) ideal Spring morning, birds chirpy; (12) birds twittering in trees; (13) impression of opera house, light, music, and courtesy; (14) everyone happy, tally-ho starting; (17) dancing, good company; (18) happiness, gay party of young people enjoying a frolic; (21) singing of birds, bright and happy; (22) twittering of birds. The last three are less easily grouped, (20) moonlight in Spain, emotion light and passing; (1) many ladies talking at once; (5) trout fishing with varied success. Thirteen express in varied imagery an emotion of cloudless joy. Four of the thirteen express this under the imagery of bird-twittering, which is probably the original burden. Three find a rather indifferent emotion, pleasant, however, rather than unpleasant. Conclusion.—The selection expresses some sort of happy gaiety.

As conclusion to be drawn from the experiment as a whole, it seems possible to hold provisionally that music has a somewhat definite emotional content, and that impression of this is received by the average listener, but with varying intensity. The formal content seems to be furnished entirely by the mood, associations or temperament of the individual. A great difference exists both in the capacity of individuals to receive definite impressions and of composers to convey them. To overcome a strong individual mood, requires music of extremely strong expressiveness. In average passive susceptibility the same general emotion is aroused with varying individual emphasis on different sides of the emotion. The dominant tone is usually caught and held to the exclusion of the subordinate emotions.

CONTRIBUTIONS TO THE PSYCHOLOGY OF RELIGION.

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II.—SOME ASPECTS OF RELIGIOUS GROWTH.¹

The present study is, in part, a supplement to the one on "Conversion."² It intends to find how the phenomena before, during, and after conversion are common to the experiences of persons whose growth has not been marked by any apparently sudden break, and to see how far the finished product following conversion and gradual development correspond. It sets out primarily to see what insights into the spiritual life and what laws of growth will come from throwing together several religious biographies, so that their like and unlike elements can be ascertained. The reader will be helped in appreciating the purpose of the study, and in following the long array of facts below, by noting briefly the method used in carrying out the research. It is purely an empirical study of the individual religious biographies at hand. The object was to use them so as to show the sequence of development of each, and at the same time the common and different elements in the various ones. After trying and discarding various ways, a satisfactory one was hit upon. An enormous folding chart was made, ruled horizontally, and also into vertical columns. Without any prepossessions and without wanting to find any particular fact, the first case was scattered item by item horizontally through the chart. The second one was sown along in the same way, but care was taken to bring similar facts under each other. As the cases multiplied they began to form vertical columns of like facts. The columns fell gradually into groups of columns, and new ones were constantly forming. Soon the whole thing had to be torn down and started afresh to approximate the new groupings. After several months' work, 195 condensed biographies had been written underneath each other, with their similar facts in vertical columns. There were finally about fifty columns, each ready to supplement the others. The following pages are intended simply to give as faithful a report as is possible in brief space, of the harmonies and discords among the facts and the glimpses they furnish of spiritual laws. If the research should

¹ Acknowledgments are due President G. Stanley Hall and other members of Clark University for helpful suggestions during the preparation of the article, and especially to my wife, who has been a constant stimulus and has done much of the actual research. The work could not have been successful without the kind coöperation in bringing facts together of several persons. Those who did most were: Dr. John Bigham, De Pauw University; Dr. Frederick A. Gast, Franklin and Marshall Theological Seminary; Professor Elbert Russell, Earlham College; Professor Earl Barnes, Stanford University; Professor Absalom Rosenberger, Penn College; Professor L. A. Williams, New Jersey State Normal School, and Rev. W. G. Thompson, Worcester, Mass.

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contain anything new or of value, it comes principally from the method used. It is simply an attempt to reduce individual opinions and presuppositions to the minimum, and let the facts of human experience speak for themselves. Each fact of experience is trying to reflect the world-forces that produced it. By patiently following up a group of related phenomena, one may be led into a glimpse of the psychic laws in accordance with which they were produced.

The raw material for the research was wholly from autobiographies. A few were found in books complete enough on the religious side to use. The greater number were written directly in reply to printed lists of questions sent out at three different times. The majority were in response to this syllabus:

I. What religious customs did you observe in childhood, and with what likes and dislikes? In what ways were you brought to a condition to need an awakening—faulty teaching, bad associations, appetites, passions, etc.? What were the chief temptations of your youth? How were they felt, and how did you strive to resist? What errors and struggles have you had with (a) lying and other dishonesty, (b) wrong appetites for foods and drinks, (c) *rita sexualis*; what relation have you noticed between this and moral and religious experiences? (d) laziness, jealousy, etc.

II. Influences, good and bad, which have been especially strong in shaping your life:—parental training, works, friends, church, music, art, natural phenomena, deaths, personal struggles, misfortunes, etc.

III. If you have passed through a series of beliefs and attitudes, mark out the stages of growth and what you feel now to be the trend of your life.

IV. Were there periods at which growth seemed more rapid; times of especially deepened experience; any sudden awakening to larger truth, new energy, hope and love? At what age were they? How did they come:—some crisis, a death, meditation, some unaccountable way, etc.?

V. Have you had a period of doubt or of reaction against traditional customs and popular beliefs? When and how did it begin and end, if at all? Have you noticed any relapses or especially heightened experiences? How did they come and with what were they connected?

VI. What motives have been most prominent at different times—fears, remorse, wish for approval of others, sense of duty, love of virtue, divine impulse, desire to grow, etc.? In what ways do your feelings respond religiously to God, nature, institutions, people, etc.?

VII. State a few truths embodying your deepest feelings. What would you now be and do if you realized your ideals of the higher life?

VIII. Age, sex, temperament, church (if any), and nationality.

The number of cases used is 195; males, 75; females, 120. They are largely native-born Americans. Of other nationalities are English, 12; German, 4; Scotch, 3; Irish, 2; and one each of Swiss, Danish, Russian and Canadian. The Americans are pretty generally distributed among the states. The leading denominations are about all fairly represented, and no one far exceeds in numbers. The church connection is not always stated. Those reporting it are: about a score each of Methodists, Friends, Presbyterians and Episcopalians; about half as many each of Congregationalists, German Reformed and Baptists; a smaller number each of the Lutheran, Unitarian, Catholic, Universalist, Jewish, Moravian, Spiritualist

and Greek Church, and 7 had no church connection. Too large a portion are college-bred for the groups to be entirely representative, though in that and all other respects the class is reasonably satisfactory. All the reports were used except one, which was too vague and imaginative to understand, and a few very fragmentary ones. Without exception they have the stamp of perfect sincerity, and generally of the utmost frankness. Complete reliance was placed on the statement as given by the subjects, so that the facts are their own but for possible distortions from condensation. Fortunately the ages are well distributed, with the exception of the girls between 16 and 19. These outnumber, due, in part, to the large number of returns from the New Jersey State Normal School. The classification, according to ages, is shown in Table I. The determination of age groups is somewhat arbitrary, but not wholly so, as will appear. Those above 40 are scattered along to the 55th year.

TABLE I.
Showing distribution of cases used, according to age.

AGES.	NUMBER OF CASES.	
	FEMALES.	MALES.
16-19,	45	6
20-23 (males. 20-21).	18	21
24-29 (males. 25-29),	18	18
30-40,	19	17
40 or over,	20	19

It should be said in regard to the younger females that their experiences were given in general, as fully and as well as the others, as the result of their constant training in self-analysis. Wherever it would avoid distortion of results the different age groups are considered separately.

Childhood Religion. There is great uniformity among the cases in regard to early training in some of its outward aspects. Nearly all report careful teaching, and the usual customs of attendance on church and Sunday school or family prayer, the evening prayer, or Bible reading, and Bible stories. There are 7 females and 4 males who had no special religious training, and 12 females and 2 males reared under more or less unfavorable conditions religiously.

The most marked feature of childhood religion shown among the subjects studied is the unquestioning way in which they accept the ideas taught in church, Sunday school and home, and unconsciously conform to them. These quotations are typical: *F.* "Had always been taught there was a God, and took it as a matter of course, never doubting my parents' word." *F.* "Said prayers faithfully, but had no real religious experience until 13." *M.* "Went through religious exercises as a matter of course, and with entire faith." *M.* "Simply accepted for truth what my parents and pastor said." *M.* "Tried to experience everything I saw, but generally, I think, with poor success." In this class of instances the element of imitation is more noticeable among girls, and that of obedience among boys. *F.* "Was influenced mostly by the example of those about me and the unselfishness of my parents." *M.*

¹ *F.* signifies female, and *M.* male.

"Believed I must do right because God and mother said so." Expressions showing some form of credulity and conformity (*omitting possible inferences*), occur in 31 per cent. of females, and 59 per cent. of males.

Incredulity and distrust sometimes begin to show themselves already in childhood. F. "Had a secret distrust of God who permitted the sufferings of Christ." F. "Father died when I was 6. Prayed he might come back. Prayer was not answered. It shook my faith in prayer." M. "In doing wrong I thought God wasn't affected by my puny acts." Five per cent. among both boys and girls.

A similar phenomenon to credulity and conformity is described in such phrases as the following: F. "Do not remember the time when I wasn't vitally concerned in religion." F. "Think religion began with birth." M. "Always felt myself a child of God."

In contrast with credulity is the disposition of the child to act spontaneously in response to its surroundings. The way most frequently mentioned in which this shows itself is in coming into close relationship with God or Christ. F. "Asked God to do things on condition that I would do a certain part." M. "Always asked God for the most trivial things." F. "Felt that God was on my side." F. "Told God many things I would not tell my parents." F. "Used to use most endearing terms to God, thinking He would be more likely to listen." M. "I loved Jesus with all the fervor of a child's heart." F. "Had implicit confidence in God's love for me." F. "Always asked God to do things for me, and promised Him things if He would answer my prayer." These few quotations suggest that this *rapprochement* of the child with its supernatural world shows itself variously,—love and trust in God; using Him for its own petty ends; bargaining with Him; and in the sense that God and heaven exist for the child, and are near at hand. The relative value of these is given in Table II.

Fears are common, though fewer than love and trust. F. "God was an awful merciless Being." F. "The sense that God was watching over me frightened me in the night. I prayed and repeated, 'I am Jesus' little lamb,' and felt secure." M. "As child, had terrible fear of hell."

Between love and fear are awe and reverence. F. "Was filled with awe when at meeting." M. "Thought God was a stern old man."

Likes and dislikes for religious observance are, perhaps, good indications of the beginning of religious feeling. Likes are far more common with girls, dislikes with boys.

The sense of right and wrong germinates early, and is evidently one of the most potent factors in childhood religion. M. "Couldn't sleep until I had said my evening prayer." M. "As a child, tried to do right always." F. "Had no religious training, but prayed a good deal to be made good." F. "When 7 I stole some cookies. Worried over it for three days. Confessed to God, wept and prayed. Felt something more was necessary. Finally confessed to mother, and was forgiven."

The relative significance of the facts given above may be seen in Table II.

TABLE II¹

Showing the relative prominence of some features of childhood religion.

	PER CENT. OF CASES FOR EACH ITEM.	
	Females.	Males.
Credulity, conformity, etc.,	31	59
Religiously inclined from childhood,	16	19
Incredulity,	5	5
Bargaining with God,	4	2
God as talisman,	5	5
God and heaven near at hand,	14	5
Love and trust in God,	17	12
Sum of four preceding—Intimate relationship with God,	40	24
Awe and reverence,	4	7
Fears—of future, of God, etc.,	16	7
Dislikes for religious observances,	9	21
Pleasure in religious observances,	17	7
Keen sense of right and wrong,	22	15

The table is full of suggestions. A few points deserve mention. That credulity and conformity occur in at least about one-half the cases, and intimate relationship with God in about one-third of them, are points of value to the teacher and parent. It was a surprise to find credulity so much more common among the boys than among the girls, and the reason is not very clear. A little light is thrown on it by contrasting it with intimate relationship with God, which is much more distinctively true of the girls. It would seem to indicate that girls are more imaginative, more actively responsive to their surroundings, perhaps more largely directed by feeling and more precocious than boys. Something like this seems to underlie the likes among girls, and dislikes among boys, for religious observances, and that both loves and fears are more characteristic of the girls. Fear is prominent, but less so than love—a fact of great pedagogical value. Awe and reverence, which are often regarded as the highest religious feelings,² are conspicuously absent. They appear to develop later, as was probably true in racial history. The budding of conscience so early is an important point. It may be one of the principal lines along which the religious consciousness is to develop.

Some other aspects of childhood religion will come up in the later discussion.

Period of Clarification. Late in childhood, and toward the beginning of adolescence, there is a more or less definite clearing of the religious atmosphere. It appears to be the rule with girls, and

¹ In interpreting tables the reader should bear in mind that the figures only suggest the absolute prominence of each item, but are of especial value in marking the relative prominence of related groups. For example, credulity may have been actually present in every case, but was potent enough to have worked itself out in words in only about one-half of the biographies. The figures are the *least* estimate of the value of the separate items. The principle is that of two related facts each is equally liable to be mentioned, if they are equally potent elements in one's nature; and the strongest one more liable to expression. The principle is not necessarily true in specific instances, but as in all scientific work the assumption is that in a large number of cases, errors balance each other.

² Cf. James Martineau: "Types of Ethical Theory," Vol. II., p. 206.

is frequent among the boys. It is as if the ideas about God and duty, which during earlier years had been external to the child, had now taken root in its life. Heretofore they had been embodied in precept or custom or his own playful imagination. Now they have begun to be his own. Often the growth from within has been unconscious, and the freshly organized little world presents itself to the child as something large and new, and with an emotional accompaniment. The awakening is manifested variously. In putting the instances together, they fell naturally into three groups—a fresh insight involving a distinct rational element; a first hand perception of right and wrong; and an emotional response. These instances illustrate:

Insight. F. "One morning when a child coming home from church, as I was walking in at the gate, the thought came to me, 'There is a God.' I had always been taught it, but never realized it until just at that time." F. "When 11 I awoke to the realization of deeper truths." M. "At puberty I became more serious and rationally conscious." M. "When 15, began to realize for myself the importance of prayer, and to feel that God was a spirit."

Moral. F. "When 9 the seeds which had been sown began to grow. Did wish earnestly to be good. Would go into lonely places to pray." F. "When 10 I became especially good at home and at school. I do not know what made me think so, but I thought God loved me better. It influenced me for good for a long time after that." M. "My inward development began at this time, (14), marked by a general clearing up of moral ideas." M. "Told a lie when 14 (had done evil things before, certainly). The lie revealed to me my conscience."

Emotional. F. "When 11 I had a sudden and violent awakening—a continuous state of religious fervor. Had had a dangerous illness." F. "When 10 I had a sense of being saved. My religious nature was awakened, and I felt for myself the need of religion." M. "While sitting alone at home one Sunday, thinking of religious duties, I heard a distinct voice within me: 'My son, give me thy heart.'

Grouping these and similar instances, we have Table III. The gross result is that there is a pretty definite period of clarification

TABLE III.

Showing some facts in regard to religious clarification preceding adolescence.

CLARIFICATION SHOWING ITSELF AS—	FEMALES.		MALES	
	% of Cases.	Average Age.	% of Cases.	Average Age.
Insight.....	10	12.9	7	(12)
Moral	17	10.6	11	14.1
Emotional	21	10.6	5	(12.2)
Unclassified	3	(9.1)	9	13.7
Sum of above.....	51	10.9	32	13.2

with at least half the girls and one-third the boys (complete records would doubtless have made the per cents. higher), and that it occurs at about 11 for girls, and about 13 for boys. It is thus seen to be a very common pre-adolescent phenomenon. It is significant that girls first awaken most frequently, and boys least frequently on the emotional side. The spiritual world of the boys organizes most often as a moral one. New insight is least often the beginning for girls.

The exact age was not always given. This, with the fewness of the cases among males, makes the average ages put in parentheses in the table too uncertain to build on. Taken as a whole, the fact seems substantial and safe that there is a difference of about 2.3 years between the sexes. The ages for girls range from 8 to 16, but mostly from 10 to 12, inclusive; for boys they are more scattering, but fall principally between 11 and 15. Taking the cases of girls in which the exact age was given, they form this series.

Number of cases,	6	7	13	10	10	2	4	3	1
Age,	8,	9,	10,	11,	12,	13,	14,	15,	16.

The year of greatest frequency is 10. Considering the emotional awakenings alone, which are more distinctively the characteristic of the girls, nearly all the instances occur at 10, 11 and 12. It is clear that we have here a distinct prepubescent fact that wants explaining. There seems to be nothing to supplement it on the physical side. For both sexes it immediately follows a dip in Donaldson's¹ curves of physical growth, and is on the plateau before the greatest increment at puberty. Dr. Gilbert² made tests on 1,200 school children in New Haven, Conn., of the changes with age in the ability to perform several tests involving muscular, sensuous and mental discriminations. He finds that "these changes are altogether different from the changes in weight, height and lung capacity." It may be that the physical and spiritual development is supplementary rather than correlative at this point. The increased life-force which accompanies adolescence is probably a tidal wave, on which there are wavelets. If so, this clarification aspect of growth is certainly an interesting premonitory symptom. Dr. Lindley³ finds the interest in puzzles among boys and girls culminates at 12 years. In Dr. Gilbert's experiments there is also an increased power of discrimination and choice among girls at 12, while there is a falling off of the influence of suggestion at that age. Among boys there is an increment in discrimination and choice at 13, and a corresponding decline in the power of suggestion. These ages coincide fairly with the average ages of the sexes given above. The rapid increment of the curve for female conversions at 11 years,⁴ which was explained there as a hastening through religious excitement of the normal age of conversion, may have a truer explanation as falling in line with and reinforcing the principle here set forth. The instances among the males are so few and scattering as to leave it an open question as to whether we have not here a distinctly feminine characteristic.

In the report of the *International Congress für Psychologie*, Munich, 1896, p. 449 *et seq.* J. W. David reports as the results of some

¹ H. H. Donaldson: "The Growth of the Brain," p. 66: Scribner's Sons, New York, 1895.

² Dr. G. A. Gilbert: "Studies from the Yale Psychological Laboratory," 1894, Vol. II, p. 40. Reported also in *Zeitschrift f. Psychol. u. Phys. d. Sinnesorgane*, March, 1896.

³ Dr. Ernest H. Lindley: AMERICAN JOURNAL OF PSYCHOLOGY, July, 1897.

⁴ AMERICAN JOURNAL OF PSYCHOLOGY, Jan., '97, p. 272; and p. 79 below.

tests on the contents of children's minds that the psychic development does not coincide with the physical. In his research there is an increment on the psychic side at about 11 years.

ADOLESCENCE.

The period of adolescence is somewhat naturally marked off by the facts at hand as extending from about the age of puberty to the age of 24 or 25. This agrees also with the common use of the term. Adolescence is undoubtedly the most interesting period from the standpoint of religious development as from every other. It is the great formative period. The youth is stirred by a vast undercurrent of will and emotion, and cross currents which oppose and conspire and bring into bold relief some of the forces at work in the life. The whole religious history of adolescence as it pictured itself in the charts, is too large and complex to grasp except in fragments. Certain aspects of it will be taken up in turn, and they will be seen falling into harmony.

I. *Sudden Awakenings; Deepened Experiences.* The phenomena noticed in the last section are not to be distinguished from those which come all through adolescence, except that they were the beginning, the first awakening to a first-hand experience of religious truth, generally after a credulous and thoughtless childhood. After joining church, or confirmation, or engaging in active religious work, there is often a deepening of feeling, a fresh burst of life, a sudden revival of interest.

These are a few typical instances: *F.* "Father died when I was 15. He was not a church member. Determined I would stand or fall with him. Was hostile to religion. Looked on stoically. Came to the conviction when 17 that I was living far below my ideals. The pressure became too great. A spontaneous emotional awakening came which lasted three months. At end of that time I joined church. The pressure from without and the desire to please mother do not seem sufficient to explain it." *M.* "While walking along a woodland pasture one Sabbath morning (21 years), I experienced an unusual realization of the goodness and love of God. It was the richest moment of blessing that ever came to me." *F.* "I grew up into the simple, strong, pure faith of my parents. When 15 I began to think more of God as a personal element in my life, turning to Him for comfort." *M.* "When attending holy communion at 16, was filled with a wonderful feeling and lifted up to a sense of my duty. It was a spontaneous awakening within me." These instances are almost wholly limited to adolescence. There are a few scattered ones later. There is one instance as late as 55.

M. "Graduated at 45. For ten years practiced medicine. Then, without any definite plan or human purpose, I became an ordained clergyman. It was a new unfolding, in which I had nothing more to do, seemingly, than has the bud in blossoming. Had always felt a slow moving onward and upward." The phenomenon here suggested is very closely allied, in purest instances, to conversion of the milder type. Indeed, had a few of them happened to those accustomed to describe such experiences in evangelical phraseology, they would doubtless have been called conversions. There seems to be no dividing line between the most intense eruptions from sin to salvation, which all would acknowledge to be conversions, and the milder forms of the type we are here considering, which no one would deny fall outside the designation. They form a continuous series. The sudden awakenings shade off into com-

mon experiences, so that it is an arbitrary matter to limit the class. An honest attempt to do so, keeping only the fairly well marked cases, give the following statistical result: Among the females, 80 per cent., and among the males, 68 per cent., record similar experiences. The exact age was not always given. A few persons give two such experiences at different times. In all, there were 88 cases among the females, and 50 among the males, in which the age was given. Their distribution, according to years, is shown in Fig. 1.

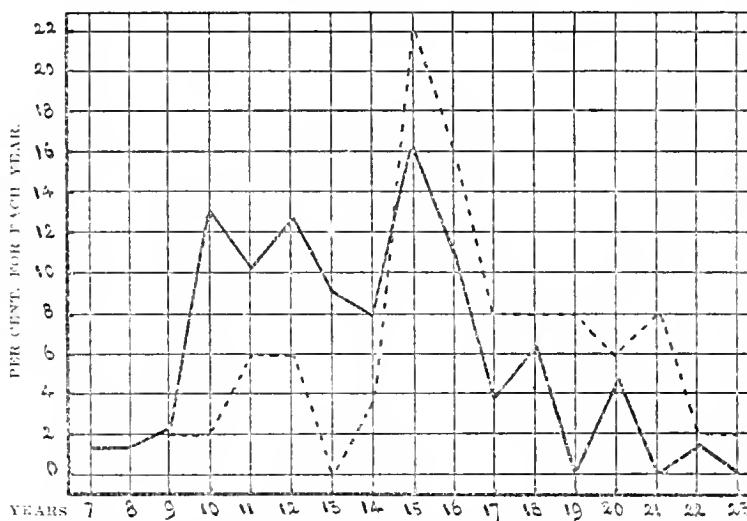


FIG. 1. SHOWING THE DISTRIBUTION ACCORDING TO YEARS OF CASES OF SPONTANEOUS AWAKENING, DEEPENER INTEREST, ETC. GIRLS.—; BOYS.....

Distance to the right indicates the age, and upward indicates the per cent. of the whole number which occur at any given year. Thus, 12.6 per cent. of the awakenings of girls were at 10 years. For both sexes they nearly all fall between the years 9 and 22. There are only a few scattered ones before or after those ages. In both sexes there are more cases at 15 than any other year, and they gradually increase up to that year and decrease after it. Mr. E. G. Lancaster has kindly furnished, from his excellent study of adolescence, just now being published,¹ 110 instances of similar phenomena. Their distribution is:

Number,	3	0	18	14	26	14	16	4	9	3	2	0	1
Age,	10,	11,	12,	13,	14,	15,	16,	17,	18,	19,	20,	21,	22.

They show about the same range, but culminate at 14 instead of 15. This may be due, in part, to the fact that Mr. Lancaster's questions did not lay stress on a distinction between conversion and gradual growth experiences. Many of his cases at 13 and 14 might otherwise have been called conversions. The fact here appealed to may at the same time account for the dip in curve F at

¹ *Pedagogical Seminary*, July, 1897.

13 and 14. This much we may say with certainty, that such spontaneous awakenings are distinctly adolescent phenomena.

There is a striking similarity between these awakenings and conversion, both in the average age of their occurrence and in their distribution through the years. Since the study of the age-curves for conversion is new and unsettled, and fresh material is accumulating on it, the reader will welcome a short diversion for a discussion of it. Fig. 2 is the curve for male and female conversions published in the "Study of Conversion" heretofore referred to.

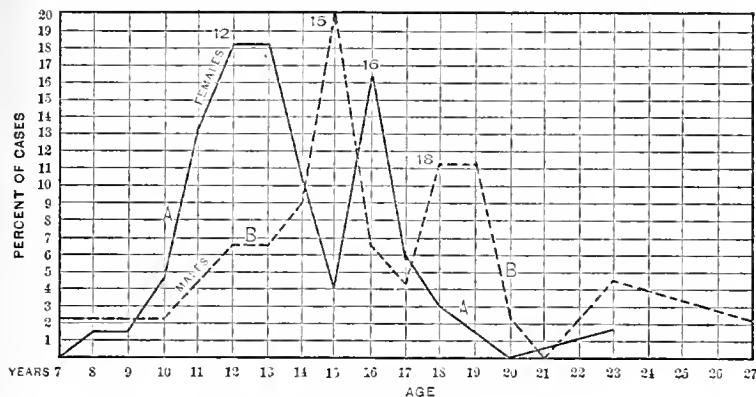


FIG. 2. SHOWING THE DISTRIBUTION OF CONVERSIONS FOR BOTH SEXES.

The conversions and spontaneous awakenings are scattered through about the same years. In both curves for females, A in Fig. 2, and the solid line in Fig. 1, there is a sudden rise after 9. If we group the years 10, 11 and 12 in Fig. 1, and call it one hump in the curve, then we have two peaks in each curve at about the same time—practically 12 and 16 in each. The two curves for males, dotted curves in both figures, are very similar, as will be seen at a glance; and both culminate at 15.



FIG. 3. SHOWING THE DISTRIBUTION ACCORDING TO AGES OF CONVERSION IN CASE OF 776 GRADUATES OF DREW THEOLOGICAL SEMINARY.

Since making the report on conversion, a copy of the *Alumni Record* of Drew Theological Seminary has come to hand, containing the age of conversion of 776 graduates of that institution. Fig. 3 is the curve their ages form. We shall call it T. It is based on enough cases to make it good for Methodist theological students. It is conceivable that it might not be entirely representative for the sex, being the record of persons of a specific kind of early training, and of persons who are afterward ecclesiastically inclined. The youngest graduates were 20. Only a very few were below 25. The probability was the same that any conversion should occur before 20, so that the curve is perfectly reliable up to 20, and pretty good as far as it extends. Curve T culminates at 16,—only a little later than the highest point in curve M of spontaneous awakenings. Curve T has also two bulges at 12 and about 20, which have their correspondence in M. Now, if we place together, as in Table IV., the average ages of spontaneous awakenings from gradual growth experiences and those of conversions, they are remarkably similar. The first and fourth items, which grow out of the groups of cases, under consideration, differ by only a fraction of a tenth. It is safe to say that conversion is not a unique experience, but has its correspondence both in average age and in distribution through the years, in the common phenomena of religious growth.

TABLE IV.

Comparing the average ages of spontaneous awakenings, conversions and puberty.

	Females. Av. Age.	Males. Av. Age.	Dif. in age.
Spontaneous awakenings, from this study,	13.7	16.3	2.6
Spontaneous awakenings, from Mr. Lancaster,	14.6	15.6	1.
Spontaneous awakenings, both the preceding,	14.2	16.2	2.
Conversion from "A Study of Conversion,"	13.8	15.7	1.9
Conversion from 776 cases above noted,		16.4	
Puberty 700 American girls (1),	14.5		
Greatest increase in bodily growth (2),	13.	16.	

That there is some sort of intimate connection between spontaneous awakenings and puberty, is strongly suggested by the concurrence of the periods. Fresh evidence occasionally appears in the records. M. "Was confirmed at 15. Contemplation of the awfulness of sin nearly overwhelmed me. Had one continual struggle with sexual passion." M. "At 14 came my first interest in Christianity. When 14 I yielded to secret sin against my body." M. "When deeply moved religiously at 16, evil made its appearance. By prayer and faith I withstood it." M. "When 14 I had a terrific love affair; (when 14) I conceived a fondness for the Stoics and bought an Epictetus, which I read with interest." The correspondence of the average age of spontaneous awakenings and accessions to puberty is seen in Table IV. The character of curves F and M in some of their minor details suggests some well-recog-

¹ Chas. Roberts: "Physical Maturity of Women," *Lancet*, London, July 25, 1885; and Helen P. Kennedy, M. D., *Pedagogical Seminary*, June, 1896.

² Donaldson: "Growth of the Brain," Chap. II., based on the researches of Roberts and Bowditch.

nized facts of pubescence. For example, one notices how the curve for boys saves itself for the ages of 15 and 16, and rises above everything at that point—just the supposed age of greatest bodily transformation; on the contrary, curve F is even a little slack at 14, and does not rise especially high at any point. On the physical side, we have on the authority of Dr. Bierent,¹ for example (translating freely), “If that stage (puberty) marks an acute and violent crisis among males, in the case of females it is only an agitation. In other words, we say of a girl that her puberty reaches its culmination; of a boy, that his puberty becomes a paroxysm.” The correspondence between religious feeling and the age of most rapid bodily growth is shown also in Table IV.² Dr. Gilbert’s experiments, already referred to, likewise show changes on the psychical side at about this time in each of the nine different tests applied to the children. He says, “In almost all the mental capacities we find a sudden alteration at about the age of 13 to 15.” These various phenomena, accession to puberty, most rapid physical development, changes in psychical growth, and spontaneous religious awakenings, are so closely interwoven that we can say with certainty that *they are in some way interdependent, or are expressions of some law of growth on which they mutually depend.*

There is little fresh to say here as to the explanation of the fact of such awakenings farther than was said in the article on the “Study of Conversion.” Some of them seem to come in the most unaccountable ways. M. “Was reared in a strongly religious family, and was given to religious exercises. Was a bad boy, full of mischief. When 18 I knew I was to be a minister. No one ever told me so. I disliked ministers, and do still [at present a minister]. It wasn’t conviction of sin or sense of duty, or anything outward. It was wholly pressure from sources out of sight. I think it was of divine origin.” Several “explanations” are conceivable for such cases: a resultant from many antecedents in earlier experience; the unconscious influence of surroundings; the residue of habits of religious observances registering themselves in the nervous system, and finally rising into will or feeling or conscious recognition; a fraction of the world-force presenting itself directly to the intuitions—who knows? Psychology since Herbart has given large place to the “sphere of the subconscious.” Physiology is copious in illustrations of “unconscious cerebration.” Schopenhauer set going a fresh wave of recognition of the “world as will and idea.” Theology describes much that happens as due to the “operation of the Holy Spirit.” These are all, doubtless, different ways of saying the same thing. All are equally mysterious, and equally sacred, given only an equally devout attitude toward life—and, one may say, equally legitimate and inspiring subjects for study as to the *way in which they act.*

II. *Double awakening—in the same person at different times.* In 15 per cent. of the females and 13 per cent. of the males, there are two periods similar to the ones we have been describing. They are separated by from 1 to 6 or 7 years, but usually by 3 or 4 years. The intervening period is often one of relaxation or indifference to religion. These illustrate: M. “When 11 others were professing

¹ Le Docteur Leon Bierent: “*La Puberté*,” Paris, 1896, p. 40.

² The reader is referred for farther data on physical growth to “Papers on Anthropometry,” published by the American Statistical Association, Boston, 1894; also to Key’s measurements of Swedish children, given in Baumeister’s “*Handbuch der Schul-hygiene*,” p. 286. Based on 15,000 measurements, he finds the greatest increase in body weight to be at 15 and 16.

conversion. I was strongly moved to take part. Was thought too young to understand. Was much grieved. Lost interest, and had a tendency to seek lively company. Had no more marked religious impressions until 18. At that time I became serious, thoughtful and penitent. Found in a few days there had been quite a change." F. "When 12, during a revival, made up my mind of my own accord to leave off my shortcomings and be a Christian without making a public confession. Later was placed in unfavorable surroundings, associated with unbelievers and took up their ways, was indifferent to religion; when 18 changed surroundings. Determined to live higher life. Exemplary life of a teacher had marked influence. Since that time I have lived a changed life." Sometimes the intervening period is filled by doubts. Often it is moving on to a fuller experience, and corresponds to what is termed a 'second experience,' 'sanctification,' etc. M. "From 11 to 15 had a determination to do right. Didn't succeed. When 15 the wrong of my course came to me as a firm conviction. By divine aid I left off evil. Up to 20 I struggled with the ideal to be utterly consecrated to the will of God. Feared being called to do missionary work. Tried to enter profession of teaching. Saw it wasn't to be my profession. After a long, hard struggle I gave up my will to God. Since then I have had joy and peace." F. "When 12 was much troubled about salvation. Found a book which said that God and not self was the proper object of contemplation. This brought comfort. It was my first real insight and first rush of feeling toward God. When 14 came in love with the ideal of perfect surrender and perfection. Would lie in bed and think just of God, God, God, with much sense of being shut in by divinity." In the case of females, the first experience is on an average at 12.1 years, and the second at 15.4, making a difference of 3.3 years. Among the males, the average of the first is 13.7, and of the second 18.2, with the difference of 4.5 years. This rise and fall in religious interest or activity in the individual seems to correspond exactly to the dip in the curves for groups of individuals. In the conversion curve, Fig. 3, a depression will be noticed in each of them. There is a corresponding trough in each curve in Fig. 1, though it is not so marked in curve M.¹ It corresponds in the individual to the dead period that is often remarked by teachers and parents.

Looking more carefully at the curves, one sees three periods instead of two, which coincides with what one must feel in working through the cases. The first we have already noticed and called the period of clarification. For both sexes it comes at about 12. The five curves in Figs. 1, 2 and 3 each show it. It is weak among the boys, but very pronounced among the girls. The second is at about 15 or 16, where the curves generally culminate. This is the point near their centre of gravity, and corresponds closely with the age of puberty. The third period is a post-pubescent one. It is pretty clearly marked in curves M, F and B. It is suggested in T in the bulge at about 20, and in noticing that the centre of gravity of the curve, 16.4, falls beyond the highest point by nearly half a year. Exactly opposite to the first period it is more characteristic of the boys, while the girls show signs of it. Noticing the general outlines of curves F and A, and leaving out their exaggerations at 15 and 16, they will be seen to gradually descend after 10 and 11, while on the contrary M and B gradually rise up to 18 or 19. Generalizing all of them roughly, they seem to indicate the tidal wave of religious feeling at puberty, with a wave preceding and one following its crest. To make it true for both sexes we may represent the fact roughly by curves G and B in Fig. 4. G would represent

¹ Curves F and M are the curves for girls and boys respectively in Fig. 1.

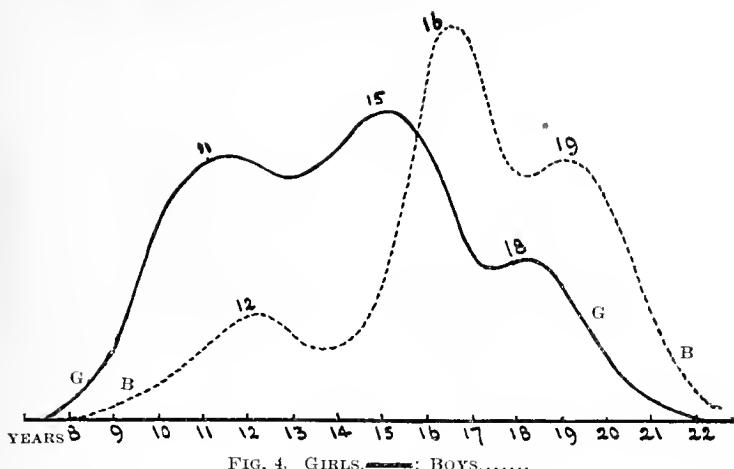


FIG. 4. GIRLS.—; BOYS,.....

the sudden increase in spontaneous religious phenomena among girls up to 11 or 12, and its gradual decline after puberty. Curve B shows the opposite tendency among the boys. Each curve has three crests. While it must remain simply as a fact of growth—if it proves to hold true as a general law—a few considerations help to understand the curves. That G precedes B, and rises higher at first, is in accord with the facts of childhood religion; that boys are more credulous, while girls react more freshly on their surroundings; the boys conform, while the girls show an emotional response. The girl is perhaps by inheritance the conserver of racial experience which comes to her naturally and early, while the boy has to work his way gradually into it. As will be seen later, the first rise in G is the period when storm and stress of feeling sets in for girls, bringing with it a loss of spontaneity. It is the time when *doubts* set in for the boy, through which he gradually works toward a realization for himself of the content of religion. The later experiences which give the third rise are much more mature and show more insight and spiritual health and vigor than the earlier ones. They seem to correspond to a period of mental maturity, as the second rise does to physical maturity. The same thing was observed in conversions.¹ Mr. Lancaster finds a similar fact in his study of adolescence. Dr. Bierent² divides puberty into three stages—the premonitory stage, puberty itself, and the succeeding stage. The last follows by a year or so. It is characterized in part thus, translating freely again: “He (the young man) is no longer astonished at his sensations. He reasons about them. His ideas become more serious and his judgment more certain. He is in the perfect blossoming of intelligence and memory.” The following two sections will illuminate the curves still farther:

III. *Storm and stress; ferment of feeling; distress; anxiety.*³

¹“Study of Conversion,” p. 277.

²“*La Puberté*,” p. 36 *et seq.*

³A research that discusses several of the points given in the following two sections is that by Dr. Wm. H. Burnham: “A Study of Adolescence,” *Pedagogical Seminary*, June, 1891. Many of the points brought out here have additional value only in corroborating his observations with fresh data.

Early adolescence is clearly a time above all others when new forces are beginning to act, new powers to function. They seem to well up out of the sea of the unconscious. They show themselves first as feeling — sometimes as a fresh burst of life, as we have seen, but more often with a pain accompaniment, giving the period that has aptly been termed the "Storm and Stress Period." It is as if the being were struggling to give birth to new ideas and fresh life forces, which it really does do a little later, as we shall see. It is as if the life were being strained or torn by the pent-up winds that sweep it, and which are trying to vent themselves in some way. It is by no means the exception, but the rule for such a period to come. There is a well-marked display of the phenomenon in 70 per cent. of the females and 52 per cent. of the males.¹ It is well to observe in the beginning that females more often undergo such experiences than the males. It is for them, likewise, a more severe and intense period, beginning earlier and is of shorter duration. Putting the storm and stress experiences together and letting them fall into groups according to the way the feeling showed itself, they formed the following groups:

(a) The sense of incompleteness and imperfection: *F.* "When 14 I had a pitiable struggle to do what I thought I ought. I often got out of bed and prayed for reconciliation and peace of mind. I struggled and strove to be willing to lead others to Christ." *F.* "From 12 to 16 I lived a sort of up-and-down life. Tried hard to be good. In times of deep trouble I have prayed and prayed in anguish of spirit." *F.* "I suffered for years thinking the joys of religion were not for me." *M.* "From 16 to 20 was a period of struggle. I came upon higher ideals and didn't live up to them even approximately." *M.* "When about 18 I studied and thought long on the question of sanctification. The experience I sought was not in a conquest of marked evil habits, and on the whole was rather vague. Two or three times, with fear and nervous apprehension, I took the start, saying, 'Now I claim as mine perfect holiness;' but I found nothing very different save a trying nervous strain of anxiety and painful scrutiny, lest some shade of thought should prove false my mental claim to perfect sanctification."

The distinction between this heading and the next, the sense of sin, which was noted in the "Study of Conversion" (p. 288), appears here also, and seems to be an important one. The former one contains an active element and implies an incipient constructive moral consciousness.

(b) The sense of sin: *F.* "Was extremely nervous and passionate, and lacked self-control. I alternately sinned through weakness, and morbidly brooded over my wicked nature. At times I concluded I never could be good, and might as well not try; then would follow a long fit of remorse." *F.* "When 11 I began to think about the future. Became restless; everything I did seemed to be wrong; then I would make fresh resolves not to do it again." *M.* "When 17 I began to seek salvation. Felt helpless and convicted of sin." *M.* "When 14 I fell in with wayward companions. Was upbraided by conscience. It was a terrible period of life; felt remorseful and convicted of sin."

(c) Friction with surroundings: *F.* "Joined church at 14. At 18 I couldn't believe many of the doctrines of the church. Felt

¹ Mr. A. C. Nutt of Ohio State University has published privately a thesis on "The Advantage of Philosophic Training," in which he finds that 67 per cent. of the cases studied had passed through a period of storm and stress.

myself a hypocrite, and often wished I hadn't joined." *M.* "From 13 to 16 I dreaded coming in contact with Christian people; to be compelled to attend family prayer, church and Sunday school was severe punishment. Often felt a voice saying, 'Repent,' but was too stubborn and wouldn't yield."

(d) Asceticism: *F.* "From 13 to 15 religious enthusiasm and mysticism ran high. Had read my father's books on the mystics. I practiced fasting and mortification of the flesh. Secretly made burlap shirts and put the burs next the skin; wore pebbles in my shoes. Would spend nights flat on my back on the floor without a covering." *M.* "Didn't enjoy religious observance, yet forced myself to it. As a matter of conscience spent hours each week on my knees."

(e) Brooding, depression, morbid introspection: *F.* "Was naturally reticent about religion. At a revival I rose for prayer. Afterwards thought I wasn't a Christian. The pastor talked to me about joining the church—I couldn't talk to him. Went back into my old feeling of unrest, and grew more and more into myself." *F.* "From 13 to 17 I became very morbid; took but little interest in life at all. The cause was probably ill health," *M.* "At 24 fell into morbid hopelessness and unwise self-dissection. Every imperfection was thought a sin." *F.* "Joined church on probation when 12. Went home and cried, for I didn't feel happy. Did everything I could to appease my conscience; read the Bible, told mother everything, put aside my jewelry—felt very solemn and unhappy."

(f) Fear of death and hell: *F.* "When 15 began to have a horror of death. I didn't believe in immortality; had almost a frenzied despair at the idea of going out into nothingness. This grew until the idea made life infinitely, wretchedly hopeless to me. Would have become insane, I think, had hope not come." *F.* "From 8 to 17 I had horrid fears of having to live an eternal life."

(g) Distress over doubts: *F.* "When 16 the study of history led to disbelief of what I had been taught. All my ideals in life were smashed. Talked with college friends, and we spelled out many things together. Very bitter feeling accompanied it." *M.* "Up to 18 I had tried to weigh the matter of religion with the cool reflection of a judge. Now it loomed up large and some solution seemed imperative. It enlisted my emotions, and the struggle was severe."

(h) Connected with effort to control passion: *M.* "At 15 I made a desperate effort to control passion. Prayed and cried, but couldn't resist." *M.* "Had terrible struggles (19) to control passion. Often would as soon have been dead as alive. Was in hell for about two and a half years." *M.* "From 14 to 21 yielded to secret sin. Each time came remorse and prayer for forgiveness. When 21 I confessed publicly having yielded to sin, and determined to confess each time."

A numerical estimate of the part each of these items plays is given in Table V. The table will be misunderstood without a caution. It gives only the relative value of the various headings at the time when feeling reached its highest points in adolescence. That the fear of death and hell, for example, does not appear in the column for males does not mean that they are not troubled with it, but in no case were such fears central in the adolescent disturbances among the males. The average ages for the separate items are suggestive. Fears come earliest. The sense of sin is next, and comes earlier than the feeling of incompleteness, which involves a greater element of will and insight. Latest are the struggles with doubts.

TABLE V.

Showing the relative prominence of the ways in which storm and stress manifests itself.

Storm and stress shown as—	FEMALES.		MALES.	
	Per Cent.	Av. Age.	Per Cent.	Av. Age.
Feeling of incompleteness and imperfection,	25.	14.3	11.	15.4
Sense of sin, remorse, etc.,	15.	13.	13.	14.
Friction against surroundings,	9.	15.6	16.	13.8
Asceticism,	5.		3.	
Brooding, morbid conscience, etc.,	31.	13.6	6.	15.6
Fear of death or hell,	7.	11.7		
Connected with beliefs,	8.	16.	31.	20.7
Connected with control of passion,			8.	14.3

The per cents. show that the feelings in youth centre principally around the feeling of incompleteness (aspiration after an ideal, etc.), the sense of sin, a morbid sense of right and wrong (brooding, self-analysis, etc.), friction against surroundings, and anxiety over questions of belief. Fear of death and hell is small. It was noticed also that it seldom rose to the surface preceding conversion (p. 285), however much it may have furnished a strong background in the sense of sin. It is a point of first importance to the teacher. There are feelings of a higher order which can be appealed to. Asceticism is almost absent.

The differences between the sexes are so great that they can hardly be considered together. Brooding, morbid sensitiveness and fear almost belong to the females. Females far excel also in the feeling of incompleteness, the struggle after an ideal, while the males are working out their ideals from the side of the intellect, as is seen from the greater anxiety of the males over doubt, apparently as 31 against 8. The same thing is indicated in the greater friction against surroundings among the males, which may indicate the germination of the power to judge and choose. Among the males fears are comparatively absent; brooding is present in small degree; the constructive and rational elements are greater. In the rough this is the greatest contrast that appears. The facts throw great light on the differences of temperament of the sexes. The push up through adolescence of the male appears more constant and persistent. The female agonizes her way, and perhaps loses much energy in the process. The contrast grows, doubtless, out of constitutional differences between the sexes. The storm and stress of the female often clearly grows out of imperfect physical conditions or continues until ill health results, and there is often a strong suggestion that such is the case when not definitely stated. F. "Before joining the church at 12 I was very unhappy. When joining church I felt like laughing. As time went on I was sometimes happy and sometimes miserable. Wasn't very healthy." F. "These periods are not always aroused by any particular occurrence. It seems they are very often the result of mood." F. "Was terrified at the idea of losing faith. I cried and prayed. Couldn't sleep, and lost appetite. Suffered from blues and depression. Night after night I went out into the dark crying out to the life that dwelt in the universe to help me. Felt absolutely aloof

from everything, a broken thing." *F.* "Wandered in darkness and doubt four or five years. Lost health." *M.* "I became thoroughly morbid (13-17). Thought I had committed the unpardonable sin. Was growing fast, and physical vitality was low. Mother was alarmed at my perfectly hopeless spirit. Was substantially in the state of being willing to be damned for the glory of God."

It is not improbable that such experiences may be traceable to racial customs that make for ill health and unhygienic conditions in the present. If so, it suggests an educational question of vast import,—how perfect regimen can be brought most effectually to contribute to spiritual health and beauty. All the facts before us in this section unmistakably raise the question of how the life-forces in youth can be best conserved and utilized.

The average age of the beginning of the storm and stress period for females is 13.6 years, for males is 16.5, which is nearly the same as the average age of most rapid physical development for both sexes. The duration of it is on an average 3.1 and 5.5 years for females and males, respectively. That it should continue longer in the male than in the female is in harmony with most of the other facts we have noticed, and also coincides fairly with the relative duration of "conviction" preceding conversion in the two sexes (p. 285),—roughly, half as long for females in each. The preconversion phenomenon seems to continue only about one-fifth as long,—one among the many indications that conversion is a condensed form of adolescent growth. The distribution of storm and stress through the years, giving the years when it began, is seen below. For the purpose of comparing males and females for the same years, the numbers between 8 and 18—about the first and last years for females—were made out on the scale of 100.

Age,	8	9	10	11	12	13	14	15	16	17	18
Females,	2	2	7	5	21	15	15	5	11	9	4
Males,					4	4	12	28	28	12	4

It should be observed that these figures represent the beginning of the period of storm and stress. The similarity of the series for both sexes is strikingly similar to the schematic curves for spontaneous awakenings above. The inference seems to be that *when the feelings begin to assert themselves actively they announce the beginning of adolescent storm and stress.* Such experiences are not confined to the limits set above. Two females have them as late as 30. There are several cases among the males between 20 and 30, and one as late as 50. *M.* "At 50 my despair reached such a height that I could do nothing but think, think of the horrible condition in which I found myself. Like lines converging to a point, so unanswerable questions pressed to one black spot. I only saw one thing—death; all else was a lie. Felt I could no longer live."

The facts which precede bear strong evidence that adolescent storm and stress is due to the functioning of new powers which have no specific outlet. They force for themselves an expression in one way or another. Two of these we have already noticed. The first, a burst of life, a fresh consciousness of a first-hand appreciation of truth, a personal hold on virtue, joy and the sense of well-being. But if there is no channel open for free expression the energy wastes itself against unyielding and undeveloped faculties, and is recognized by its pain accompaniment, distress, unrest, anxiety, the heat of passion, groping after something, brooding and self-condemnation. Looking through the cases we find the next

way for consideration is that in which the energy expresses itself in motor terms, and results in—

IV. *Heightened activity.* This is by no means one of the most common outlets for the stored-up energy of adolescence. Twenty-six per cent. of the females and 20 per cent. of the males, or about one-fourth of all the subjects studied, show a period of marked religious activity. The immediate inference is probably not true that the females are more given to religious activity than the males. The latter seem to have the active element as a constant one throughout youth, while the females, as will be seen, are more apt to fluctuate between activity and feeling. It is no doubt more than a coincidence that the average age of the beginnings of storm and stress and of the period of heightened activity should be exactly the same for females—13.6 years, and about the same as that for spontaneous awakenings. In the case of males it is a half year later on an average—17 years. The distribution through the years is nearly the same as that for the phenomena already noticed. The duration is about 4.5 years for both sexes; occasionally it extends nearly through adolescence; but it is the rule for the person to be overtaken soon by doubts, indifference, or ferment of feeling.

Sometimes, especially among the females, the fresh life shows itself at the very first as deepened interest and activity. F. "Began to take an active interest in church since I was 10." F. "From 9-16 I was much interested in spiritualism, as my parents were of that belief. I looked on unbelievers as ignorant. When 16 I saw that Spiritualists were no better than any one else, and now am skeptical as to my belief or feeling." M. "When 16 religious faith became the all-absorbing interest of my life, and I thought it should be for all men." Sometimes, strangely, the two periods begin nearly together. F. "I joined church when 13. Read the Bible faithfully, and studied the discipline. Then my real troubles began." F. "When 16 I became ultra-evangelical. Was proud and impetuous, along with self-renunciation. Ascetic tendencies were strong. I thought pleasures were a snare. Was over-humble." Frequently activity seems to come as a relaxation from doubt and painful feeling. F. "From 11 to 15 worried over religious problems. Became morbidly sensitive, shy and fearful. When 15 I went away to school. Then came a period of fanaticism. Became horribly and stiffly religious." F. "When 10 my anxiety took a religious turn. Books and teaching made me expect conversion. Worried over doctrines. Had imaginings about being one of the non-elect. When 12 I joined church, and became very active in religious work. Had anxiety for the salvation of others, and lived in an odor of sanctity."

In a few cases activity extends throughout adolescence, and seems to take the place of a storm and stress period, even in impulsive and sensitive natures. F. "Was impulsive and puritanically conscientious. When 15 was fanatically imbued with Swedenborgianism. Was earnestly and stringently bigoted, dogmatic and self-righteous. Tried to make converts." F. "My oldest sister was baptized when I was 10 years old. It inspired me with an entirely new feeling toward the church. Became devoted to it, and was very active. Wanted to be baptized, but mother wouldn't let me, but I was as faithful to the church as ever. Was baptized at 18. They teased me about my religion, but I held my own." The question suggests itself whether it is not highly desirable that youth should be a time of very great activity,—whether the percents representing the prominence of heightened activity and storm and stress, respectively, should not be reversed.

V. *Doubt.* Another aspect of what is working in the adolescent life is reflected in doubt. It is the most common of all the features of youth. Among the cases before us 53 per cent. of the females and 79 per cent. of the males have had a pretty distinct period of doubt, and it is generally violent and intense. These tendencies to doubt do not seem to be exclusively the consequence of any particular kind of training or temperament. They seem to belong to youth. Often they spring up without any apparent cause. It is more often the females than the males who are not able to trace the cause of doubts. F. "As early as 11 or 12 dark thoughts would sweep like a nightmare over me without any outward cause. Thought it all a fable which I had been taught about God and heaven." They often suggest connection with physical conditions.

F. "Have had times of doubt, when I wondered almost if anything were true, and how we could believe it. It would usually come at times when I felt unusually despondent and nothing went right. It would end as soon as I felt better." It is common in both sexes for doubts to work their way quietly from small beginnings. M. "When 15 I got hold of a book giving the Egyptian origin of the Moses idea, and the Assyrian origin of Genesis, Chap. I. I thought it skeptical. Did not suspect at the time I had lost faith in anything. At 17, at high school, was growing skeptical, though I did not recognize it at the time. I remember to have suspected the principal of 'doing' his piety as an academic requirement. Later I stood quite outside the Bible." F. "After prayer I would repeat slowly, 'For Christ's sake,' wondering what it meant. When 15 I became disappointed in the Bible in not finding beautiful things there. Revulsion came, and I said to myself, 'I don't like the Bible.' I did not allow the thought to grow. When 18 my sister said she did not know whether to believe in Christ or not. I sprang up excitedly and took her to task severely. In a year I doubted as much as she." The occasion of doubt, with males, is most commonly the study of science and philosophy, or books, or new surroundings which awaken new ideas. M. "Studied Darwin and Hume. This, with personal failure, led to doubts of the divinity of Christ, the genuineness of the Old Testament, and to the belief that spirit is not separate from matter." F. "When 16 I read the doctrine of evolution and 'The Idea of God.' Everything seemed different. I felt as if I had been living all my life on a little island, and now was pushed off into a great ocean. Have been splashing around, and hardly know my bearings yet. Don't see any need for the belief in resurrection."

The most prominent influences mentioned as occasions of doubt are shown in Table VI. The table shows only their relative import-

TABLE VI.

Showing the relative prominence of the occasions of religious doubt.

Occasion of doubt—	FEMALE.		MALE.	
	Per cent.	Per cent.	Per cent.	Per cent.
Educational influences,	23		73	
Natural growth,	47		15	
Calamity (death, misfortune, etc.),	9		9	
Misconduct of Christians,	2		3	
Unanswered prayer,	7			
Ill health,	12			

ance. Educational influences stand highest for males, while most frequently doubt comes to the females as natural growth—fresh evidence for what was shown in the curves for spontaneous awakenings,—that the female is more the racial conserver, and is impelled by unconscious forces. The fact that unanswered prayer and ill health occasion doubts only among the females is also suggestive.

Turning now to the objects of doubt, we find them to be, principally, those things which have become crystallized into creeds and theologies and passed on by tradition. Considering both sexes together the things doubted in the order of frequency are: the authority or inspiration of the Bible, the divinity of Christ, some attribute of God (as His goodness or justice), His existence, and immortality. This is the order, also, through which the doubts progress usually in the same individual. The variations from it are indefinite, and the number of other objects of doubt is very great. Some of them will be seen in these illustrations: *M.* "When 18 certain educational influences led me to doubt the absolute truth of the Bible. It was a gradual process. By 20 I disbelieved in a personal God. The way was thought out step by step. Stopped prayer because it seemed idolatrous. At 21 stopped Bible reading." *M.* "Intended to enter the ministry. Began the critical study of the Bible under ———. Doubts set in. In practical life also I came to see that what I sought *successfully* was sought under natural law. The next five or six years was a period of constant transition under study and reflection until the supernatural factor disappeared, and by 28 I would have answered the question of God and immortality in the negative." *F.* "At 15 I began to give up faith of childhood point by point, as it would not stand the test of reason. First the belief in miracles went, then the divinity of Christ; then, at 18, metaphysical studies showed me that I could not prove the existence of a personal God, and left me without a religion." *F.* "When 18 I began to doubt the Bible. I read books inclined to increase my doubt. By 19 I ceased to find any firm ground to stand on in Christ's atonement; it didn't seem just or right. I wanted to stand before God with no intercession. Soon a personal God gave way to power—vague, unformed. Sometimes I called it Goodness."

The differences between the sexes, as to the objects of doubts and the way of approaching them, are so great that the males and females demand separate consideration. The line of approach already considered is the customary one for males. They begin with doubts in regard to specific things, and work their way gradually toward doubt of the most abstract and universal conceptions. The females, on the contrary, most often begin by doubting the existence of God, or by lumping everything together and questioning it all at once. For example: *F.* "I had a religious awakening when 12. Two years later I had bitter struggles for my belief. Reason seemed to undermine my faith on every hand. When praying the question continually arose, 'Where is God, to whom I am praying? Who is He?'" *F.* "Joined church at 13. Shortly began to think about God—where He came from, etc. Kept dwelling on it till I almost doubted His existence." *F.* "Joined church at 12. Since then have had many doubts and struggles. Have had the feeling that I didn't really believe what I said I did. This has gradually deepened until I don't know now (17) what I do believe." *F.* "Doubts began at 20 in connection with the death of a very dear friend. Its form was philosophical agnosticism, beginning in materialism and distrust of traditional faith."

Some of the more important details in regard to the things first doubted are seen in Table VII. It shows only the object on which doubt began. The table shows only the relative prominence of the

TABLE VII.

Showing the relative prominence of the first objects of doubt.

Doubt began in regard to—	FEMALES. Per cent.	MALES. Per cent.
Traditional customs and beliefs (generally specific).	8	25
Authority or inspiration of Bible.	12	20
Divinity of Christ,	5	12
Existence of God,	17	5
Some attribute of God (goodness, justice, etc.).	14	5
Everything,	14	7
Immortality,	5	2
Lives of Christians,	5	2
Special Providence.	8	
Not specified,	12	22

separate objects of doubt. The actual number can be estimated by remembering that there are 64 female doubters and 59 males. The difference between the sexes appears strikingly. The first three items in which males excel are the specific ones. The following ones which are more central and vital, more abstract and general, are more frequently doubted forthwith by the females. It suggests strongly fundamental differences in the mental and spiritual life of the sexes. The woman feels more, has a keener intuitive life, responds in more organic and indiscriminate ways, lives more in the heart of things than man. A definite circumstance or experience is apt to be interpreted in universal terms. The doubts of special providence, for example, which are not mentioned by the males, usually come in connection with personal disappointment or unanswered prayer.

The distribution of the cases of the beginning of doubt, made out on a scale of a hundred, for both sexes gives this series:

Age,	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Female,	12	6	12	14	16	16	10	10	2	4						
Male,	2	2	12	10	7	7	17	10	10	2	5	7	2	2	5	

Besides the contrasts between the sexes, which are evident from the series, there are a few points worth noticing, which come out on comparing this with the distribution of spontaneous awakenings. Doubts begin oftenest with the females at 15 and 16, which is after the period of most rapid physical growth. Among the males there are fewer cases at 15 and 16 than just before and just after, which is exactly the contradiction of the curves for both spontaneous awakenings and physical growth. That is, for both sexes the beginning of doubt seems to arise most frequently outside the nascent periods for physical and spiritual activity. There are too few cases to warrant anything more than a tentative con-

clusion, but the indications are strong that the beginning of doubt corresponds to a period of arrested mental and physical activity.

A comparison of some of the leading facts of the preceding sections is given in Table VIII.

TABLE VIII.

Comparing some central facts in this and preceding sections.

	FEMALES.		MALES.	
	Av. Age.	% of Cases.	Av. Age.	% of Cases.
Spontaneous awakening,	13.7	80	16.3	68
Heightened activity,	13.6	29	17	26
Storm and stress,	13.6	70	16.5	52
Doubt,	14.9	53	18.1	79

Noticing first the percents, it should be remembered that spontaneous awakening somewhat overlaps heightened activity. Storm and stress and doubt supplement each other for the sexes, the former being more characteristic of the females, and the latter of the males. In more than 40 per cent. of the cases in both sexes storm and stress and doubt both occur, either at the same time or successively. Of those who have one without the other, 27 per cent. of the females have storm and stress without accompanying doubts, while only 10 per cent. of them have doubts without having them attended with distress; on the contrary 37 per cent. of the males have doubts without the ferment of feeling, while only 10 per cent. have storm and stress without being plunged into doubts. That is, we may say in short that *adolescence is for the female primarily a period of storm and stress, while for the male it is in the highest sense a period of doubt.*

We see from Table VIII and the series preceding it that doubt comes considerably later than the phenomena discussed before. The first three items in the table, spontaneous awakening, heightened activity, and storm and stress are more matters of feeling and will, while doubts involve more of the intellectual element. This points strongly toward the conclusion that the primal fundamental thing—that in which the religious consciousness first begins to show itself actively—is feeling and will; later the intellect is called into activity, and the person begins to analyze, discriminate and reflect. Furthermore, the facts seem to indicate that the process going on, as it pictures itself up to this point, is the birth of individuality. The child who at first showed so much credulity and constructive imagination has become a nucleus of volition, and begins to possess the power of appreciating inherent worth; then comes the breaking away from old lines of habit; the tearing down and reconstructing: these all seem to be steps in the birth of selfhood. That will come out more clearly in the later section as the subjects themselves tell of it.

VI. *Revolt against traditional customs and beliefs.* More than half of those who doubt come a little later to feel themselves quite outside the conventional mould, and to feel a definite antagonism to the beliefs and customs in which they have been nurtured. Leaving out the females from 16 to 19, inclusive, since many of them may have become reactionary later, we find that 35 per cent. of all the females and 47 per cent. of all the males have passed through a more or less definite period of revolt, which continues generally five or six years.

The following is not an attempt to give a classification of the phenomena of revolt, but only to draw a few lines to assist in their description:

(a) Revolt is most commonly the natural outcome of doubt, reasoning, analyzing, criticism, which results finally in a philosophical reconstruction that seems to set aside conventional religion. *F.* "Began questioning everything. Popular beliefs seemed unreasonable; studied science when 19. Rejected old beliefs, and find it impossible (20) to come back to them." *F.* "Read (when 19) 'Inquiry Concerning the Origin of Christianity.' It awakened thought; only desire was to know truth. Refused to attend church at cost of a family rupture. Renounced orthodoxy." *M.* "Reared with Calvinistic surroundings. Left home at 18; talked with liberal people; listened to liberal clergymen. It resulted in my conversion from dogmatic tradition. Came to regard tradition as superstition." *M.* "When I began to reason and read books that taught common sense I was disturbed. Ended it by becoming convinced that what I had been taught was false and wrong." This process, largely an intellectual one, is far the most common one among males.

(b) Very often the reaction is worked out unconsciously, and comes as a natural growth; or traditional beliefs are felt to be transcended by the individual grasp of truth. *F.* "I joined the — church when 17. Went to communion once, but my feeling was only one of horror. It seemed heathenish. Never went to church after that, or read the Bible, but prayed much. Believed in holiness, but was horrified at what I saw around me. Still believe (24) that the — church and its doctrines are death to the religious life." *M.* "From 18 to 24 I gave up all the traditional beliefs one by one. Left off Bible reading and attending church. Spiritual growth rather preceded the doubt. Always felt beneath me a strong foundation of truth. It was giving up a weaker for a stronger incentive to virtue." *M.* "The church seemed to be an excrescence which gave the lie to Christianity."

(c) Frequently the individual and his surroundings come into antagonism. There is a clash. In the inability of the person to harmonize himself with it, his integrity is threatened and is preserved only by his pitting himself against his surroundings. *F.* "One day while calling at his house, a minister suddenly asked me if I was a Christian. I had a terrible dread of being talked to about religion, and blurted out, 'No!' Was so worried I could not sleep for a long time after that. Was more careless about doing right. Could listen coolly to prayer and see baptism without the least bit of feeling; only felt far away from it all." *F.* "Suffered one bereavement after another, and finally (21) bitterness filled my heart toward the avenging God whom I believed in. I tried sincerely to believe there wasn't a God, as this seemed less wicked than hating Him. For several years I had no religion at all." *M.* "I heard the first indecent story I ever listened to, told by an officer in the church. It was a great shock. It led me to doubt his sincerity and that of every one, the worth of religion, the inspiration of the Bible and the existence of God. I read books against the Bible, talked with irreligious men, studied other religions, read of crimes committed in the name of Christ."

(d) The occasion of the reaction is in many instances traceable to ill health. This is true especially of the females. *F.* "All my life has been a struggle with doubt, disease and nervousness, which affected my religious nature. Had nervous dyspepsia, was anxious and thought only of myself. Had a period of asceticism and reac-

tion with no outward cause." F. "With a highly sensitive organism, life has been a continual struggle with hereditary tendencies. At times I believe in no future and no God. Such feelings come when my vitality is weak. Within the last three years with physical culture am growing stronger physically and mentally, and life has more meaning."

(e) The occasion of revolt often seems to be the pleasure that comes from the sense of freedom. The doubter is inventive and constructive, and delights to feel that he is making his own world and is responsible to no one. F. "Didn't think it necessary (24 to 29) for a healthy person in the prime of life to believe in a personal God." F. "By the help of mystical writers, the 'Gospel of Divine Humanity' and —, I passed out of orthodox Christianity into the free atmosphere of thought." M. "I perceived that evolution conflicted with current orthodox beliefs, and held to it more strongly on that account."

(f) Reaction seems often a physiological necessity in order to gain relaxation from the strain of doubt. F. "Had a desire to lead a Christian life. Time after time, until 16, I tried to experience what others said they did. Felt self a hypocrite. After trying over and over I fell into a state of absolute indifference. Could sit through the most serious revival and make fun; thought professing Christians hypocrites." F. "After joining church I found that profession of religion hadn't altered my conduct, and I doubted that to which I stood pledged. The well-meant efforts of a friend radically different from myself in temperament made bad matters worse. I decided desperately that I didn't care." M. "I didn't believe in the doctrines of the church. Disbelieved in resurrection of physical bodies, a literal hell, an angry God, etc. I professed to believe nothing, though I did believe in God and His goodness." Closely connected with these are the cases in which the person holds aloof in order to see things in their true perspective. M. "For a year or two (18 to 20) I stayed away from church entirely, in order not to be influenced unduly by persons." This shades off into the truth-seeking spirit which is willing to stand or fall by personal conviction. M. "Began studying Plato's philosophy. Rejected miracles. Accepted conditions and took the consequences."

The feelings accompanying the revolt period are less intense and very different in character from those of storm and stress and doubt. A few typical phrases will suggest the difference. During doubt are these: F. "Had a very bitter feeling." F. "It was a pitiable struggle." F. "I went on groping in darkness." F. "Suffered much in silence." F. "Chafed against restraint." F. "Had a prolonged fit of remorse." F. "Prayed in anguish of spirit." F. "Was full of mental distress." F. "Wrestled for the salvation of others." M. "My spirit seemed to be crying out in despair and longing." M. "Became morbid. Thought I had committed the unpardonable sin." M. "Was in spiritual agony. Health was shaken."

These, on the contrary, represent the feeling during revolt: F. "Was gloomy and cynical." F. "People said I was getting cross." F. "I never think of religious subjects if I can help it." F. "I came to a state of desperate indifference." F. "On thinking how the world-consciousness might be even blinder and less-organized than my own, I gave up even the search for God, and no longer cared even to die." M. "Church got monotonous and meaningless and I stopped going altogether." M. "I professed to believe nothing." M. "The whole thing seemed hollow mockery. I

began to be disgusted with religion, and gradually dropped religious considerations altogether."

These instances serve to show the different quality of feeling. During doubt and storm and stress the person is wrestling helplessly with forces beyond his control which tend to distract and tear his spirit. It is largely a struggle between the powers that be and the force of his own individual will. During the period of revolt there is less feeling of any kind. There is greater poise. The person has either dropped the struggle, or decided it for the time in favor of his own will. The attitude is that of indifference, or of cynicism and antagonism.

These are sufficient to mark out roughly the general class of reactionary tendencies. Back of it all and central in it all seems to be the growth of the individual life. As this rises to express and assert itself, it rarely finds its own spiritual perspective co-incident with the conventional and traditional one. Then follow friction, a clash, storm and stress, and doubt, as we have seen. The individual feels his own worth. He feels, too, the force of custom and authority. These two things—himself and convention—become set off against each other. A choice becomes necessary. A little less than half allow the scales to tip toward custom, and begin the process of adjustment and reconstruction, as we shall see. A little more than half rebel and hold their own individual point of view. They form the group we have just been considering. As we have seen, it is sometimes a matter of definite choosing, but often it is one of feeling—distaste for surroundings, revulsion through ill health, misfortune, etc. The quality of mind shown during the revolt varies greatly, depending largely, evidently, on temperament—pleasure in it, cynicism, indifference, helpless submission, seeking truth at any cost, etc. How long one remains in this attitude is also, probably, a matter of temperament. A few remain there, and never recover; others are partially constructive and call themselves "agnostic;" the greater number find in the relaxation from the pain of doubt an occasion for getting their bearings, and make it the antecedent of a definite reconstruction.

That something like this is working itself out during adolescence is seen more clearly by the facts grouped in the next two sections. They are an attempt to organize the numerous details which reflect the life forces at work. The facts would say nothing without being organized; they would be even worse than in the raw state if wrongly grouped;—the following organization is the one, after a score or more of attempts, which seems best to bring harmony among the facts.

VII. *The feeling of estrangement.* It is a very common experience for persons in early adolescence to feel themselves set off in some way from others; to think their individual revelations peculiar to themselves; to look on custom and convention as something external to their own experiences;—in short, to borrow a convenient term which Hegel coined, to have a sense of *estrangement* from persons, things, and ideas about them.

Early adolescence is the time, above all others, of the dawning of new powers. The transformation seems as great on the spiritual side as on the physical. The whole being is in a state of change and transformation. It is the time, above all others, when racial and hereditary tendencies crop out. It is then, for example, when hereditary diseases are most liable to appear. As we saw in the study of conversion, it is the time when one is born into the life of the social whole, and when, as we found earlier in this paper, new forces are at work, and function spontaneously, often suddenly and

unexpectedly. On the intellectual side these instinctive impulses correspond to insight. The person once conscious of the fresh life within, everything is judged in terms of it. It becomes the new center around which everything is organized. Herein comes the sense of newness of the individual revelation, and consequently the feeling of estrangement from surroundings. M. "I have a strikingly peculiar experience and one you do not see often" [nothing of the kind appeared]. M. (When 22 he wrote to his mother) "I am not like common men. I am neither cleverer, nor wiser, nor better than the multitude, but utterly different from them in heart and mind." F. "Am different from other people. I have never been a blind follower in thought or deed." F. "At 18 I joined the church. In my earnestness I found myself almost alone." M. "Religion always seemed to me something being shown to me, and not what I thought ought to be." M. "I stood quite outside the Bible doctrine of immortality, and of Christianity and religion generally, until about the present time (27). I was an objective rather than a subjective believer in Christianity."

Often persons feel aloof from conventional religion because they feel it to be inferior to their own, or too far inferior to their ideal. M. "Forms seemed mere show and a fetter to individuality (15 to 23)." M. "Have not turned against Christianity (25), but have outgrown it. Am glad it exists for a certain class of people who can be reached by it." M., 26. "When I go to church I am repelled by the bigotry of what falsely calls itself the only religion." M. "Wouldn't go to Sunday school (14 to 19), because they wanted me to believe things I knew were not so." M. "Did not like traditional theology. Felt there was something better." F. "I thought Christians slow, stiff and conceited." F. "Am satisfied I feel more serene in church than most Christians." F. "Felt the form of joining church artificial (13 to 15). Could not talk to mother because she could not understand me." F., 17. "Almost every minister has disgusted me. No one has talked a religion that satisfied me, so I have my own." Many of the subjects show the reform and missionary spirit while in this condition, an earnest desire to bring the rest of the world up to the standard of their high truth. It would be a valuable task to find how many of the world's great reformers received their impulse during adolescence.

On the contrary, it is as common for the Bible, or church, or religious ceremonials and customs to stand for the embodiment of an ideal which the person wishes to reach. M. "Fell in with wayward companions (13 to 15). Stopped Sunday school; avoided the society of good people. Was upbraided by conscience; did often wish earnestly to be better." M. "Had a period of doubt. Tried to live a strictly moral life. Was harassed by numerous evil, invisible agencies." M. "Became painfully aware (13 *et seq.*) of the hiatus between the natural life of a boy and the supposed ideal of a Christian. Spent hours each week on my knees." F. "Felt that others had something which I lacked (15 to 17). I, only, of an orthodox race, had no honest desire for what the rest felt." F. "All through young girlhood I felt my sister's affectionate nature to be in contrast with my selfishness and shallowness. We were inseparable companions, but she was isolated because she was on a higher plane. F. "Was in extreme despair. Felt absolutely aloof from everything, a broken thing." The instances in this last group run into the numerous ones in the storm and stress period, which were described under the heading of the sense of incompleteness. The whole doubt experience seems to imply that which comes out explicitly in so many of the cases; namely, that the germinating

faculties in the adolescent tend to awaken the sense of estrangement, and to make him judge everything by his own individual insight.

The meaning of it will come out more clearly in the next section.

VIII. *Insight during adolescence is in advance of the power to execute.*

The numerous impulses that arise during youth, if expressed in some positive way, are not always expressed rightly. Like the individual variations which come in biological evolution, some are in the line of progress and persist, while others are abnormal and constitute evil. With certain natures, adolescence is a time of acting and acting wrongly, of running against a wall and suffering, of sinning and repenting, resulting finally in remorse and lack of self-confidence. *F.* "Everything I did (shortly before 16) seemed to be wrong. Would make fresh resolves not to do it again." *F.* "I alternately sinned through weakness and morbidly brooded over my wicked nature." *M.* "When 16 I broke my standards of right. Felt remorse. Struggled with new ideas. Did wrong and was in despair." This is evidently one element in the differentiation of ideals: the person acts wrongly, and in consequence is thrown back upon himself and realizes the futility of his action. This gives chance for ideals to grow.

Another element which doubtless sets the ideal in advance of present attainment is physical incapacity to act. The person quoted above, who felt the hiatus between the natural life of a boy and the supposed ideal of a Christian, says further: "I was growing fast and my physical vitality was low. Mother was alarmed at my perfectly hopeless condition." *M.* "Felt I was far behind my ideals. Fell into morbid hopelessness." *F.* "At 12 I became serious, and it increased with years. When 16 and 17 was very melancholy and pensive. Thought about the great responsibility of life. Had a desire to act, but was sure of my stupidity and inability. Suffered much in silence." We have seen above that spontaneity on the spiritual side seems to culminate just before and just after the greatest increments in physical growth.

Another element is clearly the duplicity or multiplicity of demands made on the will. Each impulse to act is inhibited by some other or others. The person is left helpless before the greatness and indistinctness of the revelations which come to him. *M.* "Passed through a period of skepticism in which I questioned even the fundamental morals. The experience fostered my natural indecision before action." *M.* "From 15 to 20 I struggled with the ideal of being wholly consecrated to the will of God. Fear of being called to do missionary work stood in the way." *F.* "I thought I ought to undertake grandfather's salvation. For months I was in a pitiable state between fear of him and for him. Prayed for him, but never dared to speak to him." *F.* "To talk to others about their salvation I considered the test of religion. Would write to my cousin and then be afraid to look him in the face."

We have seen that another cause of the heightened insight is contact with broader minds, the study of science and philosophy, and the like. Whatever be the line of approach, the disparity between insight and the power to act is a prominent characteristic of youth. *M.* "I could do nothing but think, think of the horrible condition in which I found myself. Unanswerable questions never ceased pressing to one dark spot, like lines converging to one point." *M.* "Struggling with new ideas caused perplexity up to 21." *F.* "It was hard to do any religious duty (13 to 17). Could not kneel in my room nor pray in church." *F.* "I scarcely dared to think. Was living far below my ideals." *F.* "Made many

good resolutions which would last only a few days." F. "Had strongest desire for better life. Would try, and then sink back into the same old attitude. Wasn't satisfied with self, and had the greatest regret I wasn't better."

These facts seem to underlie the whole adolescent experience, and help to illuminate the phenomena of spontaneous awakening, storm and stress, doubt, etc., which were given in the preceding sections. The first factor in it all, certainly, is the increased complexity of life which comes through the germination of new powers and the capacity for new functions. The immediate sequel to that has already been described. The next factor to be emphasized here is the seeing, but not doing; feeling, but not responding by some adequate activity; having an impulse in a certain direction, but seeing it deadened by a lack of vital energy, or through the paralysis of the will under opposing motives. Dr. Lukens¹ finds a period in the 8th and 9th grades in our schools corresponding to the years of about 11 to 15, when there is no improvement in the *ability* to draw, but a heightened *appreciation* of art. Unlike the period of 7 to 8, when the child draws everything with little appreciation of its meaning, the youth has the beginning of the art instinct without the power to execute it. This is the same thing that we find in the religious sphere. Dim, indefinable, irresistible impulses press in on one. They are too large and hazy to find definite outlet. The person is comparatively helpless in the breach between theory and practice, between insight and the ability to act, between appreciation and the power of execution.

The extreme difficulty of bridging the chasm, and the length of time, as we have seen, that the youth is left struggling toward a higher plane of life, seem to belong to the difficulty of learning new things. In the experiments of Dr. Bryan² on learning the telegraphic language, he found that each of the subjects learned to receive messages rapidly during the first few weeks of practice. Just before the proficiency required for receiving main line messages was reached, there was, without exception, a plateau in the curve of improvement extending through several weeks—a long period when "the student can feel no improvement, and when objective tests show little or none." Then follows a sudden rise in the curve. "Suddenly, within a few days, the change comes, and the senseless clutter becomes intelligible speech." This brings fresh and well established evidence to what we were trying to picture in conversion. It helps to bring many of the facts in that study and those in this into harmony. The child is born into a social organism, which, with or without his choice, has set certain religious standards that he must attain if he is to take his place as an organic part of it. His adolescent awakening is really a birth into appreciation of the demands which the social whole makes on him. The storm and stress and doubt periods, and the period of "conviction" preceding conversion, appear to be each a time of inefficient effort to apperceive and realize that which is the common experience of mature minds. After some weeks or months in the conversion cases, and some months or years in the gradual growth cases, of striving, building and developing, the new life becomes an immediate possession and a real experience.

The cure for the helplessness that comes with doubt and storm

¹Dr. Herman T. Lukens, of Haverford College, in an unpublished article, to which he has had the kindness to allow a reference here. The article is a continuation of the excellent researches on Children's Drawings. *Pedagogical Seminary*, Vol. IV.

²"Studies in the Physiology and Psychology of the Telegraphic Language," by Wm. Lowe Bryan, Ph. D., and Mr. Noble Harter. *Psychological Review*, January, 1897.

and stress is often found in activity—in doing His will and knowing of the doctrine. *F.* "Had doubts as to the value of prayer. I desired a certain thing very much and prayed for it, simply ignoring my doubts. It wasn't answered, but I have not been troubled since with doubts." *M.* "Passed through a period of doubt. My cure was activity in doing what good I could." *M.* "Have doubted everything but a mother's love and the existence of my poor self. My doubts have somehow been resolved in the stress of trying to live uprightly. Could not carry doubts far while trying to be a good son, student, husband, father and citizen."

One cannot lay it down as a rule that the wise treatment of the youth is to induce activity. We have seen that doing wrong things is often the precipitation of the difficulty. *M.* "Joined church when 15, and felt better. (Had been perplexed with fears.) Confessed self a Christian. Began to awaken to the fact that I was not. For three or four years I sought salvation; felt helpless and convicted of sin. While talking with the pastor, one day, the whole matter cleared up. It was the simple acceptance of Christ." *M.* "I lost sympathy with the doctrines of the church. Afterward tried to come back to it, but failed. Only satisfaction was a real reconciliation to the doctrines of Christ." *F.* "I joined church when 12. Was not so anxious as before, but had the feeling that I did not believe what I said I did." *F.* "Saw that my friends were living far better and happier lives than I. Felt I was living below my ideals. When 17 I joined church. Almost immediately a reaction set in and I regretted the step I had taken. Felt it had not altered my conduct, and I doubted that to which I stood pledged." The determination of the proper course as regards action or inaction during adolescence seems to be an individual matter, and depends on conditions too complex to be stated as a simple principle. More will be said of it later.

IX. Other elements which take the place of the distinctly religious feelings during adolescence.

During adolescence there is comparatively little display, as we have seen, of positively religious feelings. There is clearly more of ferment than contentment and evenness of feelings; more of doubt than faith; more of unrest, uncertainty, analysis, or, on the other hand, of willful activity and the disposition to take the control of the universe into one's own hands. We set out next to inquire what is taking place among the life forces,—is there relatively a blank, or are there other lines of interest and activity which persist during doubt and storm and stress? We are able to see clearly that there are elements which continue or which are even heightened during these experiences. The lines of interest easily recognized in the order of their frequency are the moral, intellectual, and aesthetic. *a.* The ethical instinct usually either continues or is heightened during adolescence. Often it is the only thing that remains firm in the midst of chaos. *F.* "Had lack of religious feeling, but prided myself on my humility. Determined to devote life to God's service. Went into Christian work. It seemed more practical than spiritual." *F.* "If I overstepped one thing (10-19), I felt awfully wicked. One night I had a dream of Christ beckoning me to follow Him. Took it to mean I was not doing as I should. Was even stricter after that." *F.* "It, was hard to do religious duty (13-17). Bible became uninteresting. Could not bear to see the minister come. But I had a strong sense of duty resting on me." *M.* "While changing beliefs, religion was more a matter of conduct. Went through a rational stage (17-18), when the sense of

duty only was left." M. "Passed from old views. Gradually dropped religious considerations altogether (22-26). Led an active life. Religious nature was entirely dormant, but there was an increase in moral and intellectual soundness." M. "Was in spiritual agony. Health shaken. My spirit was smitten with such a darkness that only one of all the early faiths remained—"It must be right to do right."

There are a few instances in which the moral nature is shattered and falls with the rest. F. "From 14 to 19 I could not bear to be talked to about religion. Heaven seemed further off than ever. I was more careless about doing right." M. "Began to doubt theological beliefs. Went to college. Overthrew ideals of childhood (18-19). Had a period of moral license." M. "Had a period of skepticism. Questioned everything. It lowered my ideals unconsciously, or doubled them with lower ones while the higher ones persisted."

b. The intellectual interest is often the absorbing one. It now and then seems to approach a kind of æsthetic of logic. F. "When 15, intellectual questionings arose. Became intensely imbued with Swedenborgianism. It was the cold philosophy of his teaching that satisfied my mental needs" F. "During the year (19) I read books inclined to increase doubt. Would go out under the stars to think and reason. Contrasted ministers of the Gospel with scientists, and thought the latter more likely to find truth. At present (23) have no settled religious belief. I accept no belief I cannot understand." F. "I said, as to something above me, I will never believe one inch beyond what my coldest thinking tells me is most probable." M. "For a year or more after 14 the whole matter of religion seemed eclipsed by the desire for intellectual growth." M. "Have never been able to supplement my most general conclusions by the mysterious strength of simple faith. Have a keen desire (31) to have a satisfactory rational basis for would-be beliefs." M. (15-19), "Cared more about my doubts than the solution of them."¹

c. The æsthetic interest sometimes either continues or is heightened during doubt and storm and stress. F. "From 24 to 29 did not believe in religion at all. Wept over the pathetic in literature; had strong emotions on hearing 'The Messiah,' or Easter music at some great church." F. "No religious training. Later I lost the calm and peace of childhood; 15 to 22 had despair at the idea of going out into nothingness. Did not believe in God, immortality or prayer. During this time I had a vague imagination of something beautiful and beneficent in nature. My enjoyment was largely sensuous; flowers, perfumes, music, deep, soft colors, awakened more emotion than any thought of the holiness of God." F. "All that religion means to me (17) is kindness and goodness. In music, soulful pieces move me strongly. Chopin's 'Funeral March' seems to grow into me. In nature, our glorious sunsets, the ocean in its vastness, and all scenery on a grand scale, make me believe there must be some divine power." M. "Came to stand quite outside religion generally (15 to 22). Natural phenomena were everything to me—health, inspiration and consolation." M. "During my doubt period (before and after 20), the love of nature constituted all my happiness. The vast and sublime affected me almost to madness."

A rough quantitative estimate of these factors is given in Table

¹Dr. Burnham observes, in his article, "A Study of Adolescence," *Pedagogical Seminary*, Vol. I, that many philosophers have begun their systems during adolescent doubt.

IX. The number of cases in which doubt or storm and stress were present is the basis of per cents. The numbers show the per

TABLE IX.

Showing the actual prominence of certain elements which take the place of religious feeling during doubt and storm and stress.

	FEMALES.			MALES.		
	Per cent. of Cases.			Per cent. of Cases.		
	Cont.	Height.	Either.	Cont.	Height.	Either.
Ethical instinct.	18	15	33	37	6	43
Intellectual interest.	6	15	21	24	8	32
Aesthetic interest.	7	8	15	14	2	16
Any one of above without duplicating.			55			63

cent. of these in which the supplementary elements in question were clearly present. The absolute value of the per cents. is heightened here because most of such statements as are quoted above did not come from a direct question, but were given voluntarily in the general record of experiences.

The ethical factor stands out in greatest prominence, persisting during doubt and storm and stress in at least 33% of the females and 43% of the males. We have already noticed the frequency of the outcrop of the moral instinct in spontaneous awakenings. Here we see it persisting as the skeleton and framework of life when everything else is torn away. It is the first thing to appear when individual life dawns and the last thing to go when one is torn by doubt and perplexity. *The ethical instinct seems to be the great tap root from which the religious nature is nourished.* It is that, probably, which connects the individual most fundamentally with racial life. The prominence of this factor, not to speak of the tone of earnestness and sincerity shown in the adolescent experiences, shows clearly that the freedom and independence claimed by youth is not a demand for the liberty of license, but such freedom as accompanies the grappling individually with one's own problems.

We notice in this table, as in the former one just referred to, the prominence of the intellectual factor in adolescence. The aesthetic element remains, too, a strong factor to which to appeal when faith is low. These all, doubtless, represent demands which must be met in the educational treatment of youth, and should be appealed to in order to help him safely through a most critical and crucial period. Several minor points in the table will reward a glance. The fact, for example, that the factors noticed are usually heightened among females while they merely persist among males, is, perhaps, more than a coincidence.

One of the most significant aspects of the facts above is the evidence that if life forces are not expending themselves in one direction they are probably active in another.¹ Because youth is not

¹ Mr. H. S. Curtis of Clark University is trying to show and making it appear highly plausible that the amount of nervous energy available for use in any given time is fairly constant.

running on evenly and smoothly, we cannot safely infer that there is not growth,—it may be the very best thing that could happen. In fact when we take into account the great frequency of doubt and storm and stress, and view it in the light of the facts given in the last three sections, it suggests that the extreme experiences of youth, with all their unevenness and turmoil, may be the result racially of a survival of the fittest, in which the fittest is he who wrestles in youth with the inextricable mesh of impulses that spring up, and even pauses in despair while the deeper forces of his nature are working themselves out into clearness and harmony.

THE PERIOD OF RECONSTRUCTION.

A turning point almost as distinct in character as that at the beginning of adolescence is one a few years later, which consists in a reorganization, a readjustment, a reconstruction of religious experience. Adolescence is a period of turmoil, of spiritual unrest and often of negation; this, on the contrary, is the beginning of religion seen from within, a positive faith. It consists either in an independent construction of beliefs and faith, or in coming back to old forms and dogmas and putting into them a vital meaning. More frequently it is both; the person has acquired a spiritual grasp and that becomes the basis for appreceiving the vital elements in old doctrines, generally with keen discrimination between their essential and non-essential aspects. These quotations illustrate:

F., 20. "Cannot come back to old beliefs, but I believe I worship as truly as God desires." *F.*, 26. "Am influenced in my own conduct by far higher considerations and nobler ideas of duty than I ever was while I held evangelical beliefs." *M.*, 21. "The struggle is over, but my beliefs do not now agree with all the popular ones." *M.*, 30. "I have come back to a firm belief in God as revealed by the Holy Spirit in Jesus Christ, but I cannot return to the traditional beliefs concerning inspiration, atonement, the person of Christ, election, etc." *F.*, 30. "The terms God, freedom, love and immortality have more meaning to me now than ever before, not so theoretical as a few years ago, but nearer and more real" [from 24 to 29 she was "without a religion"]. *F.*, 54. "I have often thought that if I could come to the Bible as to other books, it would be more helpful. The last year or two it has been more helpful; the illumination which evolution has thrown on some passages will eventually make it a new book for me." *F.*. "From 17 to 24 I was constantly awakening to larger meanings of truths heretofore supposed narrow and personal." *M.*, 30. "Have returned to something like the faith of youth, but it is much more spiritualized and liberal in its views." *M.*. "Gradually (16 to 20) I lost all my religion but the sense of duty. Then gradually I felt that I hadn't lost much—it all came back to me transfigured. Since the re-adjustment my religious feelings have tended to become stronger and I have put new meanings into old forms."

Omitting the girls between 16 and 20, who are not supposed to have yet completed the reconstruction, we find 42% of the females and 39% of the males who have had experiences similar to those quoted above. Allowing for imperfect records and for difficulty of self-analysis, it is evident that such experiences are very common. They stand in contrast to the facts under section VII above. If we continue the Hegelian terminology we may call this the period of reconciliation. To what extent this is a characteristic experience will appear below.

The result of an attempt to classify all the cases with respect to this feature of growth is given in Table X.

TABLE X.

Showing some facts in regard to the trend of religious experience.

	AGE.									
	16-19		20-23 (24)		24-29 (25)		30-39		40 and over	
	% of cases.	F.	% of cases.	F.	% of cases.	F.	% of cases.	F.	% of cases.	Sum. % of cases.
1. Faith reconstructed after doubt and negation.	1.7	2.5	4.1	10.8	9.2	28.3				
			2.7	10.7	12.		13.3		38.7	
2. In process of reconstruction.	3.3	3.3	2.5	.8	.8			10.8		
			12.	4.	1.3		1.3		18.6	
3. Still negative.	10.3	0.	.8	.8	0.			12.5		
			1.3	2.7	0.			.0	4.	
4. Gradual growth without definite reconstruction.	16.	9.	7.	3.	6.7	9.3	6.7	10.7	41.7	38.7
Unclassified.	6.	0.	.8	0.	0.			6.8		

The cases fall into four groups. First, those who had got more or less completely outside of religious interests through doubt and reaction, and had finally constructed a belief and faith satisfactory to themselves. Secondly, those who had gained some solid footing and were still making stringent efforts to believe. Thirdly, those who were still negative and reactionary. Lastly, those who had never felt themselves removed from and antagonistic to religious interests, even during doubt and storm and stress. The separation into these groups was of course somewhat arbitrary. That it was not wholly so was shown in the fact that, as in other points of difficult judgment, my wife and I made them independently and found very few doubtful cases. These last are placed in the unclassified list in the table. The value of the table is largely in showing the distribution of the different groups among the various years. It is made out entirely in per cents. of the whole number of cases. As we saw in Table I, the number of cases which fall in the various year-divisions is about the same, with the exception of the females between 16 and 19 inclusive; so the per cents. as given represent fairly, with the exception of the first column, the relative values for the different vertical columns, *i. e.*, for the different year-groups.

Noticing only the column of totals, we see that much less than half the cases, 41% of females and 38% of males, develop so evenly that they do not show a definite tendency to become external to religion at some time in their growth. If we exclude the 16% from this class of females between the ages of 16 and 20, we have for both sexes about a third who belong to this class. That is, if these

are typical subjects, we may say that *about two-thirds of both sexes tend, at some time in their growth, either to rebel against conventional religion, or to find it external to their personal interests.* The gradual process of growth is more characteristic of the females than the males.

Looking now at the year-groups, we see from class one that the numbers increase with years of those who have had a period of definite reconstruction. In contrast with that, the number of those who are still reactionary, or are still in the process of reconstruction, decreases with age. That is, it appears that very few who have stood outside of religious interest at any time in their growth, have not readjusted their faith by, say, the age of 30. That class four—those whose growth is distinctly gradual—should be greater in earlier years, can hardly mean other than that they would have been good subjects for doubt and reaction later. The naive and simple way in which most of the girls from 16 to 20 gave their experiences, and described them in the phraseology of the prayer-book or catechism, is added evidence. If the table is accurate, and the facts on which it is based are typical, we may safely say that *the common trend of religious growth is from childhood faith, through doubt, reaction and estrangement, into a positive hold on religion, through an individual reconstruction of belief and faith.*

The age at which the reconstruction occurs is generally between 20 and 30. Of those before and after these ages are: of females, one each at 18, 33, and 37; of males, one each at 50 and 55. The age was not always given, but it was evident that the reconstruction generally fell somewhere between the years specified. The average age at which the reconstruction occurred among the females is 24 years; that of the males, omitting the two at 50 and 55 respectively, is 24.5 years. In order to see if this was a separate period or only a continuation of the phenomena of spontaneous awakenings, the numbers of both occurring at the different years were plotted together. They leave almost a blank at 19 and 20, and rise again to greatest frequency at 25. The phenomena are also of quite different character, as will be seen from the quotations already given.

That there is a critical period somewhere in the 20's is also shown by the fact that many of the cases that had perfectly even growth during adolescence, had a turning point at this time: *F.* "When 20 I heard — impersonate David Garrick. Experienced a swelling and overflowing of life, and joy so keen it was part pain. That high plane of insight has never been lost." *F.* "When 23 I had a struggle with selfishness and came out victorious." *M.* "When 21 I became more serious. Growth, from that time, was less influenced by environment." *M.* "At that time (25) came new insight into the meaning of life." Putting experiences of this kind with those of reconstruction of faith already noticed, it swells the per cent. to 53 for each sex of those who have a pretty distinct turning-point somewhere in the 20's. The average age given above is changed by only a little with the addition of these last. It appears, therefore, *in a majority of cases, that there is a critical period in religious growth, usually between 20 and 30, at which religious truth is apperceived, and takes shape as an immediate, individual possession.* It is a time when the ragged ends of experience are pulled together into a unity; when that which has been objective is now subjective; when that which has been seen from the outside is now lived from within.

So far there seems to be nothing on the physiological side, and little on the psychical, to help explain this turning-point. Neuro-

logically, it may correspond to internal adjustments rather than to any measurable aspects of growth; psychically, it marks the end of the adolescent ferment. The bigotry and willfulness of adolescence become toned down, the unrest and hopeless striving become realized. If the experiments in learning telegraphy, referred to above, do hint a fundamental law of growth involved also in religious experience, this culmination of adolescence is the time when the curve of proficiency suddenly rises and crosses the line which represents the standard of the religious life of the social whole. It may be wide the mark, but it seems possible that this turning-point in question may be an accumulation from racial experience, and represent the time when the individual must leave his tutelage and take his place as a positive unit in society, as husband, or father, or citizen. After the period of reconstruction there is seldom a change in the general tone of the religious life. Then is when, usually, its character is determined, and the pace is set which it keeps throughout active life.

The way of approach to positive religious life from adolescence is frequently clearly marked:

(a) Through some sort of activity, sometimes activity of a general kind: *F.* "Had severe struggles through selfishness and jealousy. Family troubles came upon me in full force. I saw I could bear my sorrow only through serving Christ and working for Him. I took a class in Sunday school and sang in the choir. I set up ideals and made great effort to live up to them. My real change in character began at that time." Other instances were given in section VIII under Adolescence. More frequently the activity is of a special kind along the lines indicated in the following three headings:

(b) Following up some thread of intellectual insight: *F.* "I knew that an acorn would not come up a beanstalk, and thought that to plant in that belief is as much religion as anything. Came to believe that 'somehow good will be the final goal of ill.' One cannot live without deep religious feelings; they are a legitimate part of one's nature." *F.* "Got hold of the conception of law. Settled the problem of the world in favor of determinism. This brought repose and rest. Gradually ceased to pray for anything external, but only for spiritual perfection. My whole after-life has been a development from this point of view." *M.* "Reaction practically ceased by my becoming convinced that, allowing the Bible equal credit with other sacred writings, it was, as a whole, true; that the religion of Christ was the most potent factor in lifting humanity to a higher plane; that the church was the only organized means of advancing religion; and by seeing fruits of religion in the lives of others." *M.* "Learned to distinguish between the lives of so-called Christians and that of Christ; between imperfections due to Christianity and those due to human weakness. Went to a favorite grove by the river, summed up all my doubts and fears, and Christ was mine again." Others found some organizing principle in science or philosophy. The typical solution seems to be in sifting a large truth which is part error and discriminating out the vital element in it, as in the last one above and in this: *M.* "By 18 I was a skeptic, by 20 an unbeliever. When 21 I came under the instruction of a man who taught me the difference between essentials and non-essentials. He taught me that if I had the mind of Christ within me, and had the spiritual truth of the Bible, it made no difference about Jonah and the whale. He first really led me to Christ."

(c) Following the thread of duty: *F.* "One day while musing

despairingly, something stirred within me, and I asked myself, 'Can I not rise once more, conquer my faults and live up to my own idea of right and good, even though there be no life after death? I may yet deserve my own respect here and now. If there be a God, He must approve me.' Was led back straight to religion through moral instincts." F. (Severe conflict 16 to 30) "When 30 I heard some sermons on religion as character building. They led me to be the Christian I am now." M. "My morals and theology both went at the same time. Came later to see the distinction between them and to have as my only code utilitarian ethics." M. "Have outgrown the church. I believe in a high standard of morals. Honesty, morality and integrity are my only watchwords and they are my prayers.

(d) Finding the vital element in religion from the side of æsthetics:

F. "The reading of Wordsworth and Keats, and Kant's 'Critique of Practical Judgment,' combined with lectures on Wordsworth and Keats, opened up a new world to me. It showed me that religion was not identical with any church. Felt God to be the great artist of all the outdoor world of which I was so fond. The change of the 'good into the beautiful' became the acceptance of God's law." A good example is found in the deepened insight of one whose growth was gradual. M. "(When 22) I drew the picture of a little aspen tree. As I drew, the beautiful lines insisted on being drawn. I saw they composed themselves by finer laws than any known to man. At last the tree was there, and all I had thought about trees, nowhere. 'He hath made everything beautiful in his time' became thenceforward the interpretation of the bond between the human mind and all visible things." The presence of the æsthetic element in the reconstruction is also hinted under the next heading. In the last three paragraphs we see, very naturally, that the way out into the positive religion is along those lines which we found to persist during doubt and storm and stress.

(e) The vitality of strength and beauty in a personal life is often the way of approach:

F. (Despair from 19 to 33.) "The chief factors in the change were change of work and love for a little child. By slow degrees came back warmth for other human beings. I became possessed, I have no knowledge how, of a little faith." M. "Never felt the emotion of love in any form until 26. A little child 8 years old had fondness for me because I told her fairy tales. Her words were the first expression of tender feeling I ever received that I did not suspect. Could understand God's love better after that." F. (Doubt and storm and stress up to 22.) "Heard a grandly benevolent man preach on the joy and peace of the Christian life. Felt a hope that it might come to me. Began to pray vaguely but earnestly for faith and a hold on truth. Gradually a sense of the wonderful vitality of the personality of Jesus came to me. His life seemed to be in all things—in civilization, beauty, purity, art and life. Slowly I felt in myself this other Life and Force and Divinity."

(f) One of the most common ways of entering on positive religious life is through the surrender of self, and coming to live in more general or universal life. F. "Experienced complete resignation and threw aside selfish anxiety about a future life. Got rid of the prison of self and took my stand in the objective universe." F. "I came to a point where to go on and live without divine aid was impossible. In a time of sore temptation help came. The simple acceptance of it changed everything. After a year or more of sore distress of mind, religious feeling came back again." M.

"My struggle was with independence. I find it easier now since I have submitted completely. My growth has been from purely intellectual religion to acceptance of the Spirit's aid." *M.* "Heretofore (up to 25) religion had been a *personal* matter. The final solution of my difficulty was in recognizing the *social* side of morality and religion. That was a brand new revelation to me." *M.* "The difference, after starting for a higher life, was that God was recognized, while before He was not."

(g) Almost, if not quite, central in ending the adolescent experiences is coming to see religion from within. Most of the avenues to positive religion discussed under the preceding headings, seem to be ways leading the person from an external perception to an internal and immediate apperception of the worth of religion. *F.* "I came to see religion as a personal matter and not limited to creeds." *F.* "I gradually came to realize (26) that vital religion is the breath of life to all earnest souls, and is not confined to churches or formulas." *F.* "From my sister I learned (27) that religion is not something tacked on to life. From external observance I passed to subjective life and oneness with Spirit." *M.* "Came to see that to know God is not a matter of the intellect, but that to live is to know Him." *M.* "Came to feel (24) that all dogmatic teaching was a matter of chance and habit; that the life of religion depended on the force of faith, not the terms of it."

To sum up: If our analysis has been accurate, the way out of doubt and storm and stress into a positive faith is in 'doing His will and knowing of the doctrine;' in being faithful to the bits of truth, beauty and goodness which remain firm during adolescence, and finding them to deepen, broaden, heighten and blossom; in catching the force of vital religion as embodied in a personality; in surrendering self and living in the life of the whole; finally, in finding religion to be life which can be appreciated from within as the heart and centre of one's experience.

EXTERNAL INFLUENCES.

Up to this point we have been looking for the processes of growth, regardless in large measure of the forces from without which help to determine them. The force of surroundings has constantly been reflected; but it is worth our while, for the sake of equilibrium, to take our point of view for the moment in the external influences and see how powerfully they act in shaping the character of the religious life, and to get a crude notion of the relative worth of these influences in the opinion of the subjects themselves.

Foremost among them are the influences of home life. *F.* "My parents have been the strongest influence of my life, religiously and otherwise." *M.* "Through their teaching and my admiration of their example, my parents have done most to shape my life." *F.* "Mother's influence has led me to be what I am." *F.* "I longed for mother's happy and peaceful look." *M.* "A spiritually-minded wife has been a constant influence for good." *M.* "Was kept steady by reflection on the happiness which so markedly characterized both my parents' and grandparents' homes."

Next in prominence is the influence of a friend or the example of persons whose character is admired: *F.* "My life was influenced most by a bosom friend, whose lofty, noble character put to shame small things in me." *M.* "I had a tendency unconsciously to imitate a friend whom I admired. Some one sinned; I smiled; my friend frowned. I never forgot it." *M.* "Was largely influenced

by a friend. He was one of the truest, 'purest characters I ever knew. I desired his good will above all else.' M. 'The strongest influence was a girl, now dead, who was a schoolmate. I think she was worthy of worship.' F. 'The sunlight of the real God in my aunt warmed and inspired me.' M. 'My uncle shook me from my lethargy and immorality.'

Somewhat less frequent are the influences connected with church life. F. 'Church has been a second home to me all my life (38).' F. 'The church has furnished spiritual food and been a rudder and anchor to my life.' M. 'Hearing a sermon led me to devote my life to the ministry.'

A brief hint of many others is found in the following: F. 'Nature calls up religious feelings constantly.' M. 'In reading books I have had a tendency to become like the persons I have read of.' M. 'The study of the doctrines of evolution has added immensely to the Christian plan of salvation.' F. 'Misfortunes have been the greatest influence.' F. 'Hard fortune has developed character and moral courage.' M. 'The sight of wicked people increased my desire to live a religious life.' F. 'I determined not to live as my father was living.' M. 'The death of my father and being thrown on my own resources have had much to do with my growth.' M. 'The death of my brother increased my faith and drew me nearer God.'

TABLE XI.

Showing the relative prominenee of the external influences which shape the religious life.

External Influences.	% of Cases.		External Influences.	% of Cases.	
	F.	M.		F.	M.
Parents (both).	23	32	Teacher,	9	6
Father,	3	1	Specific writers,	17	17
Mother,	8	6	Science,	3	8
Others in family,	3	1	Art,music,nature, poetry,	8	15
Family life,	2	12	Books (in general),	10	12
<i>Influence of home (total).</i>	34	52	Deaths,	9	13
A friend,	22	29	Misfortunes or ill health,	9	2
Example of people, <i>People</i> (sum of two preceding),	12	13	Personal struggles,	0	9
	34	42	Warning from surroundings,	2	5
<i>Church or pastor,</i>	23	29			

The relative importance of some of the influences mentioned is given in Table XI. It shows the per cent. of cases in which the different items were mentioned. One of the most striking things in the table is that the quiet influences that constantly surround childhood are recognized finally as the most potent; another is that the personal influence is so great in contrast with organized social institutions, nature, etc. One cannot insist too strongly that the

table is only suggestive. The males seem to be more conscious of the force of environment, judging by the larger per cents. in the second column. This might be due simply to the greater patience of the males in giving details. It may, however, fall in line with other facts we have seen, and tend to show that women are more subjective, while men react more on surroundings. In the study of conversion we saw that, in the process of a "change of heart," the subjective forces were greater in the case of males. But we saw, too, that males more often resisted definite, strong influences which were brought to bear. These facts, with those, seem to show that males are more responsive to the milder influences of environment, but more unyielding in the presence of forces which threaten the continuity of their religious lives.

CASES WITHOUT MARKED STAGES OF GROWTH.

Many persons grow so evenly that it is impossible to point out any transition in their development. In such cases there is little to be said of them, often, except, as we shall try to do in the next division of the subject, to indicate in certain ways what the direction of growth has been. It would be exceedingly profitable, pedagogically as well as scientifically, to know just what conditions bring about perfectly gradual growth, as distinguished from that which is tossed by the storms of youth; and to determine which is the most healthy line of growth. While the cases before us have little definite wisdom to offer on the topics, they seem to furnish valuable suggestions in regard to them.

One condition which seems to favor perfectly gradual development is wholesome religious surroundings in childhood. *F.* "Mother taught me to pray at her knee. I always had a whispered prayer that none but God could understand. When I did anything wrong mother required me to seek forgiveness. The change from careless, indifferent childhood to earnest, warm interest in God's work was very gradual, and very natural after the good training I received." *F.* "Mother was patient and gentle with me. Had church and Sunday school associations of the pleasantest kind. Was not taught anything about hell and Satan. Have not changed my childhood phrase, 'Our Father in Heaven,' except to widen the term." *M.* "Had God-fearing parents, and was surrounded with all the influences which go to make godly character. From infancy was taught to believe that I belonged to the Saviour, and that He loved me. My delight in Christian thought and association has never changed with the passing years only to become intensified."

But, as we have seen, nearly all the subjects had religious surroundings in childhood, and many of them point to the spiritual influences of the church and home as factors in shaping their religious life. Many of those who have reacted against religion appear, as far as can be judged, to have had faultless surroundings. *F.* "Had Christian parents. Up to 13 had real enjoyment in leading Christian life and in worship. From 13 to 17 was much troubled with doubts. Grew morbid, cause probably ill health; also that I thought more deeply and began to inquire for myself." *M.* "Was reared in a Christian home and sheltered as closely from evil as one could be. Was taught from the first to regard myself a Christian, and above all to do right and to please God. Stopped going to high school from nervous prostration at 16. Religion was my all-absorbing interest, and I sought to carry it out in practice. Studied and began to doubt. There came a time when I would have answered the questions of God and immortality in the nega-

tive." Instances like these show that careful training in childhood is not sufficient to ensure even development, but that we must look for other conditions.

The cases seem to show that much depends upon temperament. The evidence is such as that hinted in the two quotations just above. The report on temperament in the returns was too scrappy to be of much use. About an equal number, respectively, of the doubt and storm and stress cases, and those whose development during adolescence was even, reported a nervous temperament. There were several more of the gradual growth ones than of the others, who describe their temperaments as cheerful, phlegmatic, equable, quiet or passive. Now it is a well-known fact that with the beginning of adolescence there are marked changes in the circulation. The heart enlarges, the blood-vessels increase, and the blood pressure is heightened. This, it is believed, has much to do with psychical conditions. Lesshaft has gone so far as to make character depend largely on the conditions of circulation.¹ Combine these facts with the evidence shown in preceding pages that the phenomena of adolescence accompany certain physiological states, and we have considerable evidence that we must look to the physical side, in part, for an explanation of these two types of religious growth. Given two persons reared in perfectly wholesome some religious surroundings: if one is naturally highly sensitive, and the other phlegmatic, the former is more likely to become restless and reactionary during the strain of adolescence, while the latter may have an uneventful growth. The facts before us are only sufficient seriously to raise the question which wants further investigation.

Another pretty clearly marked condition of gradual growth is that the needs of the child shall be carefully met at every point in its development. A certain amount of freedom and independence in thought and action seems to be a natural and wholesome demand of late childhood. If serious intellectual questionings are met seriously, it appears often that youth is kept steady when otherwise it might rebel. F. "I had no religious obligations imposed upon me, but followed my own will. Childhood was a delight. Have had complete faith in God from childhood." M. "Traditional theology never appealed to me, but always since a child I have felt myself a child of God. My growth has been even from childhood." F. "A Sunday school teacher tried to impress my unworthiness and sin on me, and that I would be lost forever if I was not converted. For three years I waited in misery of mind for the expected conversion. Fortunately, a dear friend explained that unless I had done something very wrong, or had some heathen beliefs to cast aside, all I needed was to make a public avowal of my faith and purpose. Was tremendously relieved. Joined church in a month. Realize more and more my insignificance and God's power and glory." F. "As I grew older and read more and was guided and strengthened by parents and teachers, I gradually came to understand what Christianity means, and to trust it. Had religious convictions from childhood. Their influence on me grew as my love and Christian surroundings grew, and shaped gradually my spiritual life."

On the other hand, the cases are numerous which illustrate the lack of wisdom of parents or teachers in sympathizing with the real needs of persons, and the consequent reaction against social

¹ P. Lesshaft: "*De l'éducation de l'enfant dans la famille et de sa signification.*" Paris, 1894.

standards. *F.* "Was pushed by older people into questionable extremes of piety." (Years of revolt followed.) *F.* "My Sunday school teacher tried to get me to join church. When he talked to me it would harden me instantly." *M.* "My parents and teachers impressed upon me that I must believe all or nothing (14). It did not take me long to decide which." *M.* "Could not play or do anything on Sunday. Was compelled to go to church and listen to a preacher who left the impression on my mind of a blue-jay jumping up and down on a limb and scolding at me. Was compelled to read Jeremy Taylor's 'Memoirs' every Sunday. Had an utter loathing for it. Every touch of religion was paralyzing as they forced it on me and smeared it all over me. It seems now like crusting over the growing, feeding larva with the pupa case too soon." (Reaction and indifference followed from 14 to 26.)

But one cannot lay it down as a rule that freedom in childhood always brings even growth, and that overtraining invariably results in reactionary tendencies. The usual phenomena of adolescence often follow when the surroundings in childhood are natural and free, and even where there is no religious training. *M.* "Was reared in a church-going family, and accepted the beliefs of my parents as far as I understood them. Father was rather liberal and gave us freedom. When 15 the problem of religion loomed up large, and some solution seemed imperative. The struggle was severe." *F.* "Had no religious training of any kind. Went to Sunday school occasionally, but no religious feeling was aroused by it. Still, I had a religion of my own and prayed a good deal to be made good. Later, as a young girl, I began to have a horror of death. When 22 the despair at the idea of going out into nothingness made life infinitely, wretchedly hopeless to me. Would have become insane, I think, had hope not come." We see again that when the needs of childhood for freedom are apparently well met, even growth is not yet assured. We must go back of that for a part of our explanation; and, as before, the cases bear strong evidence of differences of temperament as partial cause of the different lines of growth.

One reason why the religious lives of many persons develop symmetrically and harmoniously is clearly that there is a proper mixture of faith and doubt continually—a sufficient degree of freedom to question all things to insure a clear horizon, and enough trust and insight and poise of spirit to remain firmly rooted in the heart of religion. *M.* "Doubts (18) were the occasion of giving up weaker for stronger incentives to virtue. Spiritual growth preceded the doubt. I always felt beneath me a strong foundation of truth." *F.* "My growth has been gradual. Beliefs have broadened since I came in contact with people of other faiths. Have come to see good in almost every faith, but have clung to my own church. Have accepted the later ideas of the atonement and the inspiration of the Bible. God is my rock and fortress, and I trust Him." *M.* (Clergyman of an Orthodox church) "Studies have carried me away from some of the old landmarks. I never get excited when I see another one disappearing. I have learned, too, to 'doubt my doubts.' I am an evolutionist." *M.* (Also a clergyman of an Orthodox church) "Have not passed through a series of beliefs. All my thinking has been an expansion of the fundamental conception reached while in college that the death of Christ was a declaration that there never was, nor ever could be, an obstacle between God and man. I always hail doubt as sure to reveal some unexpected truth. As often as I have tried to dodge doubts, I have suffered. My real doubts have always come upon me suddenly and

unaccountably, and have been the precursors of fresh discovery."

A few seem to have an uneventful development because they do not leave the religion of childhood,—perhaps never wake up to an immediate realization of religion. They raise the question whether it would not have been conducive to growth even to have suffered a little on the rack of doubt and storm and stress.

As one wanders through the pros and cons of this section the basal impression they fix is that the proper treatment of children and youths in regard to their religious growth must be a matter determined separately for each individual, depending partially on his or her constitution and temperament. Consequently, whether, in order to attain the highest development, the growth should be perfectly harmonious throughout, or transitional, is yet largely an open question.

THE ADULT RELIGIOUS CONSCIOUSNESS.

We may follow up the line of growth still farther by an analysis of the picture the subjects give of their beliefs and feelings at the time of making their records. By dividing them into the different age-groups, and also into groups according to whether growth has been gradual or transitional, we may get some suggestions of value. The three columns of facts that proved most fruitful were the three on beliefs, feelings and ideals—and, of these, the last two.

1. *Beliefs.* It was difficult to organize the column of beliefs so that the organization would be comprehensive and at the same time free from individual opinion. A few things which were safe and suggestive came from taking the three beliefs around which life seemed to centre most frequently, *i. e.*, God, Christ and immortality, and seeing the absolute and relative place they hold among the various groups.

Table XII is based on the per cent. of the cases with whom the belief in God, the personality of Christ and the doctrine of immortality are vital factors in life. For gross results the last line of the table shows that the belief in God plays a relatively large part, and

TABLE XII.

Showing some facts in regard to the belief in God, Christ and Immortality.

GROUPS ACCORDING TO LINE OF GROWTH.	GOD.		CHRIST.		IMMORTALITY.	
	F.	M.	F.	M.	F.	M.
Gradual growth,	41%	33%	27%	19%	14%	20%
Faith reconstructed after doubt.	27	39	10	20	10	13
In process of reconstruction,	5	11	1	1	0	1
Still negative,	2	1	1	1	2	1
Total.	75%	86%	39%	41%	24%	35%

the belief in immortality a relatively small part in religious conviction; belief in the personality of Christ is intermediate. The first and second lines show that these doctrines are more vital among the gradual growth cases than among those who have reconstructed their faith, with the exception of the belief in God and Christ

among the males. Lines two and three seem to show that the belief in God is the most central after the reconstruction of faith.

Table XIII was made in order to see whether or not these beliefs seemed to vary in prominence among the different age-groups. The table shows the per cent. of the number in each age-group with whom the beliefs were vital. Following along the lines from

TABLE XIII.

Showing the potency of the belief in God, Christ and Immortality for different ages.

BELIEF IN	AGE.				
	16-19	20-23	24-29	30-39	40 or over.
God.	Female,	69%	94%	81%	94%
	Male,		67	70	100
Christ.	Female,	28	56	37	39
	Male,		50	41	31
Immortality.	Female,	23	25	19	33
	Male,		17	29	56

left to right, we see a little tendency for the numbers to increase in the cases of the beliefs in God and immortality, and a slight tendency to decrease after 20 in the case of the belief in Christ. The most marked progression is in the line for males in the belief in God and immortality. That is, there is some evidence from the table that the belief in God and immortality is a more potent factor in life as years increase.

2. *Religious Feelings.* More fruitful are the facts on feeling. Grouping the instances according to likenesses and differences, they fall principally into five groups, which are illustrated below.

(a) The Sense of Dependence. F. "I lost myself in the recognition of Supreme Power and Love." F. "Feel my weakness and unworthiness, and long for more strength." F. "Something in me makes me feel myself a part of something bigger than I that is controlling." M. "I feel a dependence on, and an intimate relation to, a power not myself." M. "I have no confidence in myself or anything but God." M. "Have completely submitted to God's way."

(b) Reverence, Gratitude and Love. F. "Have a reverential sense of something beyond and above us." F. "Have such an awed feeling of reverence when in church." F. "The love of God is deeply rooted in my heart." M. "Have a deep love of God, which I think is growing deeper." M. "My feeling toward God is that of a son grateful for blessings."

(c) Oneness with God, Nearness to God, Divine Companionship, etc. F. "Have often a consciousness of a divine presence, and sweet words of comfort come to me." F. "Felt the personality of Jesus in me as Life, Force, Divinity." F. "Have a sense of the presence of a loving God." M. "I have heightened experiences, when God seems very near." M. "Have a sense of a spiritual presence in the world." M. "My soul feels itself alone with God, and resolves to listen to His voice alone in the depths of spirit."

(d) Faith and Trust. *F.* "Each year my faith is stronger and richer." *F.* "I have unquestioned assurance that what is pure, honorable and enlightened is best in harmony with the frame of things, and I need not see how." *F.* "When I pray a sense of love and trust comes over me." *F.* "I do not understand, but I believe God." *M.* "After getting to work for Christ, my faith took strong hold."

(e) Blessedness, Joy, etc. *F.* "When in the hills I desire nothing, fear nothing, but just exult in the reality of being." *F.* "Religious services always make me feel solemn, yet joyous." *F.* "Communion affects me deeply, I seem to be very near the gates of heaven." *M.* "Often at church my heart heaves with emotion, and finds an outlet in tears." *M.* "It has been a delight to do God's work." *M.* "Have had pleasure in doing for my fellow-men that which will make them nobler and better."

(f) Rest, Peace, etc. *F.* "I feel rest and security of soul." *F.* "I rest in the eternal goodness." *F.* "I cling to the idea of God because I find it a comfort in distress." *F.* "After communion and baptism a purer feeling goes with me through the day." *M.* "Thoughts are peaceable."

(g) There are several others which are scarcely prominent enough to form groups. These illustrate some of them: *F.* "I yearn to realize more of the Infinite." *M.* "Have a great hungering for personal purity." *M.* "I feel independent of the world and superior to fate." *F.* "Religion would mean nothing to me without the perception of the goodness and beauty of nature." *M.* "The finest qualities in human nature and the finest scenery make me say, 'Glory to God!'" *F.* "Am filled with emotions which come from contemplating the highest good I can conceive." The feelings quoted are seen to be aspiration, contemplation, sense of beauty and sublimity, sense of freedom, and hope.

A few profess to be lacking in religious feeling. *M.* "Am generally indifferent." *F.* "I never seem to get up the lively experience I strive for." *F.* "I have no heightened experiences, and cannot understand why people in books have them."

The absolute and relative prominence of the above groups is shown in Table XIV, as nearly as frequency of occurrence in the records will determine it. The numbers are the per cents. of those that discussed their present attitude who experienced these various feelings. They stand in the table in the order of frequency.

TABLE XIV.
Showing the absolute and relative prominence of religious feelings.

FEELINGS.	FEMALE.	MALE.
	Per cent. of cases.	Per cent. of cases.
Dependence,	27	36
Reverence,	25	37
Oneness with God, Christ, etc..	27	29
Faith,	17	23
Blessedness,	13	13
Peace,	7	4
Unclassified,	11	20
None.	5	1

The sense of dependence stands at the head. This accords with the tendency since Schleiermacher to define religion as the sense of dependence and freedom. The freedom side of the definition seldom finds justification in the records before us,—at least explicitly. But if one were setting about to define religion, which is none of our purpose here, it would have to be borne in mind that several other feelings are about as prominent as dependence. Reverence, which almost never appears in childhood religion, stands almost at the head in adult life. Oneness with God or Christ and trust are prominent in both Table XIV and Table II. Peace and blessedness are also frequent in adult life, but seldom appear in the records of childhood religion. Dependence in Table XIV appears to correspond somewhat to credulity, and the tendency of childhood to use God in Table II. A careful comparison of these two tables seems to show that the constant elements from childhood to adult life are dependence, the sense of oneness and faith. Fear is transformed, perhaps, into reverence. The childish familiarity with God is also transformed into reverence doubtless, which helps to change fear into blessedness and peace. Peace and blessedness would appear to follow naturally on the unrest of adolescence. Only a small part of the reverence group of feelings consisted of love which had any definite object. Love has become so complex and abstract, apparently, that it has taken the form of contemplation and reverence. Some suggestions of how these same feelings vary with age is given in the next table.

Table XV is based on the per cent. of those in each year-group who give the various feelings. Its significance is in the general

TABLE XV.
Showing how religious feelings vary with age.

FEELINGS.	AGE.									
	16-19		20-23		24-29		30-39		40 and over.	
	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.
Dependence,	13		27	19	27	50	33	41	50	37
Reverence.	22		22	23	44	50	22	41	20	37
Oneness with God,	20		22	19	33	16	27	35	40	47
Faith,	6		33	5	22	22	11	29	30	37
Blessedness.	11		11	5	5	0	22	0	15	11
Peace,	9		0	5	5	0	0	0	15	11
Unclassified,	6		11	14	27	27	11	29	20	11
None.	9		0	5	0	0	5	0	5	0
Total.	89		128	91	167	186	128	194	190	195

increase of the numbers from left to right. The most distinct increase with age is in dependence, reverence, oneness with God, and faith. The last line which gives totals of the columns shows in the most convenient way the general increase. The numbers increase pretty constantly with age. They seem to show that in ad-

olescence there are comparatively few specific religious feelings, and that these increase constantly with age. This probably does not mean that these feelings are not present in youth. The facts of adolescence, as we have seen, show that it is tossed by every kind of feeling. A truer interpretation, doubtless, is that not until as late as the period of reconstruction of the religious life, do the feelings become differentiated and take shape as specific, distinct feelings.

It will be noticed that the most rapid increase in the totals in the table is in earlier years. They would form good curves, whose rapid rise is up to and within the year group, 24 to 29. The one for females would drop between 30 and 40, and rise again beyond 40, while the one for males would increase slowly after 30. This falls in line with what we saw in other ways under the period of reconstruction, and helps to show that late adolescence is an intensely formative period, and that the life tends to take on its peculiar character by, say, the 30th year.

The number of the doubt and reconstruction group who gave specific feelings was greater than that of the gradual growth group by as much as the ratio of 10 to 7. This is just about the inverse ratio of the number with whom the beliefs in God, Christ and immortality were vital parts of religion. That is, *those whose growth has been uneventful are more apt to describe their religious attitude in terms of belief; while those with whom religion has once become objective, and faith has been reconstructed, are more apt to describe it in terms of feeling.* This bears out our previous conclusion that the process of reconstruction consists essentially in coming to make religion immediate and lived from within.

IDEALS.

The answers to the question, "What would you now be and do if you realized all your ideals of a higher life?" are, perhaps, one of the surest criteria of the trend of the adult life, granting that hopes, purposes and inspirations are at all possible of realization. This section is a simple picture of that toward which persons strive, and that, on the other hand, from which they have grown, as shown in childhood faults.

The ideals fell into several headings, more or less distinct, which are illustrated below:

1. Helpfulness to others: F. "Would be infinitely more charitable and unselfish." F. "Would bring great happiness to all with whom I am brought in contact." F. "Would like to do favors for people, even those I do not care for." M. "Would make others happy by administering to their needs." M. "Have a sincere desire to be of use, in an intellectual way, to alleviate mankind." M. "Would work with God to bring it about that 'good may fall at last to all.'"

2. Self-perfection: F. "Where once I said, 'I want to be good,' I now say, 'I want to develop, improve, grow strong.'" F. "My one motive is to grow, not especially spiritually, but every way." F. "Would live an honest, upright, beautiful, sincere life." M. "I would build up a pure and unselfish character." M. "Would be so pure and true that all who saw my life would want to be like it."

3. (a) To be one with God; (b) to love and serve God: F. "Would find God in every part of His universe." F. "Would grow nearer God by every thought and action." F. "I would be a joyful channel for the heavenly breath." M. "I would get more and more in harmony with God's laws." M. "Would fulfill God's purpose in me as a child of His."

(b) F. "Would think of God, and do good for His glory." F. "I would do what God desires." M. "Have a deep desire to promote God's work." M. "Would love God and serve Him better."

4. Self-abnegation: F. "I would forget self entirely, and spend life in an unobtrusive way." F. "Would give up everything for others, and not count anything dear for the sake of doing good." F. "Would be simpler, thinking less and less of self and living more and more objectively." M. "Would lead a life of self-denial." M. "Utter abandonment of self for the welfare of others." M. "To overcome the imperfections of youth, to renounce worldly ambition, and to attain a self-sacrificing life."

5. Christ: F. "My highest aim is to follow Christ's teachings." F. "I am trying to follow Christ's life as nearly as I can in all its glorious self-abnegation, its wondrous purity and marvelous helpfulness." F. "I would be perfect as Christ is perfect." M. "Have no definite ideal aside from Christ."

6. Self-expression: F. "Would write a book like Thomas à Kempis, or Helen Hunt's 'Ramona.'" F. "Would be a tower of strength to the suffering about me." F., 16. "My ideal is to be a woman of thirty, beautiful in form and feature; to have wonderful power with my voice; be very rich, and use all my wealth for doing good." M. "I would have a wide sphere of influence, provided the influence be for good. I desire to be loved, but am willing to be hated."

7. To know: F. "My ideal is to ascertain truth." F. "To ground my faith on known laws." F. "Would find all possible knowledge." M. "A love of knowledge and passionate zeal for the right are central in my life." M. "Am a lover of science, and am still striving to reach truth." M. "My highest purpose is to know nature, to be true to it, and to utilize it."

8. Self-interest: F. "To be joined hereafter to those who have gone on before." F. "To live so that people will think of me as having helped other people."

9. Specific virtues: Among these are mentioned the attainment of meekness, patience, sobriety, justice, honesty, cheerfulness, purity, self-control, etc.

10. Abstract and unclassified: F. "Would have heaven primary in my thoughts." F. "My ideal is the 13th chapter of I. Corinthians." M. "I am realizing my ideal in preparing for the ministry. My ideal is organic, pervading life in its totality."

The absolute and relative value of each of these groups, as shown by per cents., is given in Table XVI. The numbers represent the per cent. of all the persons giving ideals who mention the various ones.

Foremost of all the ideals is helpfulness to others. It is mentioned nearly twice as often as any other one. In the record of childhood faults, selfishness is greater than any other item among the girls, and stands second among the boys. Taking all the faults which may be classed as distinctly egoistic, such as jealousy, anger, covetousness, pride, stealing, and the like, we find them to foot up 70 per cent. among the girls, and 72 per cent. among the boys, of all the childhood faults mentioned. These facts point to the conclusion that the tidal wave of life is away from self-interest toward finding one's life in others. This is still further emphasized by the prominence which self-abnegation has among the ideals. Self-interest, on the contrary, appears only in about 3½ per cent. of the cases. Combining all these facts it is clear that *the most marked feature of religious growth, as shown by the childhood faults and the ideals of adult life, is that the trend of life is away from egoism toward*

TABLE XVI.

Showing the absolute and relative prominence of certain ideals.

IDEALS.	FEMALES.	MALES.
Helpfulness to others.	65	52
{ Harmony with God.	120	19
} To love and serve God.	18	9
Self-perfection.	29	39
Self-abnegation.	20	12.5
Christ.	14	18
Self-expression.	10	11
To know.	6	16
Self-interest.	3	14
Specific virtues.	32	27
Unclassified.	19	16

altruism. This coincides also with what we found to be the central thing in conversion.

Self-abnegation among the ideals is set off against self-assertion and self-indulgence, which are very prominent among the childhood faults. Sexual temptations stand first among the evils from which the boys have grown, or are striving still to grow. Other forms of the faults opposed to self-abnegation are drinking, stubbornness, sauciness, lying, willfulness, revengefulness, and the like, and ill-temper, which stands second among the girls in the list of childhood faults. Self-abnegation seems at first directly to oppose self-perfection, which stands third in prominence among the ideals. It probably represents the necessity for lopping off and plucking out exaggerated and harmful lines of self-activity, which make the highest self-perfection impossible. So that self-perfection becomes closely allied to self-expression, and both are closely bound up with self-abnegation. Self-perfection has also its direct opposites among the childhood faults in laziness, moroseness, pouting, shyness, etc. As the quotations above suggested, the ethics of evolution is deeply ingrained in many of the subjects. The facts show that one marked aspect of growth is the denial of self along wrong lines, and the perfection of self along right lines.

The item second in prominence among the ideals is that which involves a harmonious relationship between self and God. We saw, also, that the sense of oneness with God was one of the most common religious feelings. The quotations show that the ideal, as found in Christ, is closely akin to this in which the term God is used, in that all lines of possible attainment are felt to converge in Him. We saw in Table II the intimacy of the relation between the child and God; and that the belief in God was the last thing to be reasoned away by the males in adolescence. But the facts of religious feeling showed how the feelings of mature life had become more complex and abstract, and that the relation of the person to his surroundings had become more immediate and spiritualized. We saw how, during adolescence, the person became estranged from his surroundings, and looked at everything objectively; but that he came finally to apperceive the world phenomena, to feel

their worth, and to live them from within. We see among the ideals a culmination of this tendency. The elements of harmony and oneness are involved in love and service, in the submission of will and obedience, which were shown in the quotations. The same thing is doubtless involved, too, in helpfulness to others, which we found to be so prominent among the ideals. In short, we see that *one of the central tendencies in growth is to realize the sense of oneness and harmony with all the world-forces and institutions, and to feel oneself an organic part of the world-life.*

THE SIGNIFICANCE OF THE FACTS BEFORE US.

This is a matter, largely, for each to interpret for himself. In the process of organizing the details, they have seemed now and then to become transparent, and to furnish glimpses into the operation of spiritual forces. These have already been hinted here and there throughout the articles. This brief section is only an attempt to pull in the threads a little closer, and to make the details more organic.

We find that in gradual growth, as in conversion, the clearest terms in which religious development expresses itself are those of egoism and altruism. The end attained by spiritual growth is fundamentally that the person comes to live in some larger life outside himself. The child emerges from the unknown sea, bringing with him racial tendencies. Among these is the brute instinct of self-preservation, showing itself in anger, sensitiveness, jealousy, and the like—faults which must be outgrown. The child at first appears comparatively helpless. Everything goes to contribute to the nucleus of a self. It is in a receptive attitude towards its surroundings and dependent on them. Throughout early life, the child is held in the lap of society as at first in that of its mother. By the end of youth, however, the person must have become an organic part of the social whole, a positive factor in it, and find his life in actively contributing to it. Instead of remaining passive in the hands of the unconscious world-forces about him, he now recognizes himself as part of a larger spiritual world to which he is subject, and he finds life only by fitting into an eternal plan. He comes to feel himself in harmony with the spiritual life about him, and responds to it with the feeling of faith, love, reverence and dependence. Self-interest becomes transformed into love of God.

The child is not simply receptive. It is a centre through which racial instincts express themselves. The sea of feeling out of which it is born is constantly breaking through the nucleus of a self. As the physical organism of the child is full of automatic movements, so the spiritual nature bursts forth as aimless will; as spontaneous activity and as emotional insight. The child, as a fresh centre of activity, has its own individual peculiarities, and is ready to function in any one of an indefinite number of directions. But the standard of activity is already set. He is born into a system of things which law and custom have made habitual and fixed and strong. If the person acts in line with convention, he adds to the conserving interests of society. He may never awaken, and be ballast or dead lumber. If his line of self-expression is slightly divergent with custom, it may result in friction, but will add to the enlargement and enrichment of human experience. If the person becomes directly antagonistic to the social whole or the world life, he must either bide his time or be lopped off from society, or, finally, surrender his will to that of the whole.

The essential thing in coming to live in harmony with the universal life is not simply a matter of the right direction of the expenditure of energy, nor of self-surrender. The primary requisite is that the person shall apperceive religious truth; feel for himself its inherent worth; make it his own by coming to live it from within. At first the person is held in the straight-jacket of social custom, which habit has made reflex, mechanical and unconscious. Toward adolescence new powers begin to function. The youth begins to reason and judge and analyze, or, after unreflecting activity, to stop in disappointment. Everything is judged in terms of his own consciousness. The customs about him appear lifeless and meaningless. The available energy is largely used for physical growth. Consequently the ability to execute falls behind the power to appreciate. The youth finds himself a mere observer of the customs about him. They seem strange and external to him. The story of adolescence, as we have seen, is, consequently, one of continual doubts and questionings, storm and stress of feeling, striving after something out of reach, independence, willfulness, and even reaction and revolt. Religious feelings disappear, and in their stead the framework of religion, goodness, truth and beauty rises into prominence. Finally, after some years of striving, struggling, analyzing, building, following up bits of insight, the truth dawns, the feelings come into play to give it worth and sanction. Usually, the individual hold on truth is recognized to be the same, essentially, as that which all men possess, yet unlike that of any one, because it is an immediate revelation to one's deepest consciousness. It is the heart and essence of that which was form and observance in childhood. The person becomes at last a sympathizer with the world wisdom, a cooperator in social institutions, and enters into real fellowship with the divine. Religion is now lived from within.

The course pursued in attaining a vital hold on religion, we found to be a matter, in part, of temperament. If the vitality is low when the individual point of view begins to develop and set itself against convention, there is paralysis of the will, pain and distress. If the health endowment is great and energy high, there is stubborn resistance, doubt and reaction. Given the latter conditions, together with a sanguine temperament, and we have the youth who builds his own system and sets it against any or all the rest. The number of variations which different temperaments combined with various conditions of environment can produce, are indefinite.

Religious awakenings come most frequently, we have seen, at about the age of puberty. That is the period of greatest bodily readjustment. There springs up suddenly a whole series of new physical adaptations, which are as marked in the nervous system, perhaps, as in any part of the body. It is clearly the time, biologically, when one enters into deep relation with racial life through the birth of the reproductive instinct. There comes the possibility of full co-operation in social life through the door of the family. The new physical birth naturally brings with it the dawning of all those spiritual accompaniments which are necessary to the fullest social life.

The immediate inference from the coincidence of these two groups of phenomena is that the religious life is closely bound up with the reproductive instinct,—that it is a direct result of it, or an irradiation of it through the family, clan, society and world. The facts show that, while such an inference contains a grain of truth, it is not a correct statement of the case. The answers to the definite question on this point were usually very frank. In no instance

was the reproductive instinct admitted to be helpful to spiritual attainment, nor was the religious life described in terms of it. Love, as a religious feeling, occurs among the cases studied, more often among males than females—18% of males and 10% of females. There is no case in which the matter is discussed but that regards the instinct in question as a hindrance to the spiritual life and a thing to be curbed. There is no doubt that, biologically, the generative function is primal. But it seems to have been entirely superseded as a direct factor in spiritual growth by other elements. As society has developed, the number of units in the social complex which are directly connected with the personal life has become so great in comparison with those immediately involved in the propagation of the race that they in themselves form a centre of reference for individual conduct. The person becomes responsible to society instead of to his own feelings. The complications of industry and trade and government establish rights and duties which become more potent and absorbing than those growing out of the generative function. The reproductive instinct sinks, in comparison, into limited activity, and the person finds it necessary to curb it in order to attain the fullest spiritual development. Consequently, we have seen, during adolescence, when religious feelings disappear and there is a chance to sift the spiritual life to its last elements, the most prominent thing there was duty standing out clear and strong. There was also the truth-seeking spirit, which is doubtless a residue from man's contact with nature—his necessity for understanding it, and the satisfaction of comprehending it. The appreciation of external nature was probably in itself as much the origin of the sense of beauty that we found persisting through adolescence as the sexual life has been. In short, we find that during adolescence the reproductive instinct is held in abeyance, while the sense of goodness, of truth and of beauty which have superseded it, rise into prominence as the real roots of religion. *The sexual instinct, which continues healthy and strong to conserve biological ends, has, from a spiritual standpoint, become a mere incident in growth.* It is natural that spiritual insight should come at the time of greatest physical readjustment.

We are in a position now to see something of the relation between conversion and gradual growth experiences. We have found that the preconversion phenomena of sense of sin, feeling of incompleteness, anxiety, unrest, estrangement from God, doubts, etc., are not the result of religious agitation alone, but that they come naturally in the process of adolescent growth. A comparison of Table V in the "Study of Conversion" and Table V in this article will show that the feelings before conversion and the usual ones of adolescence are about the same feelings, and in about the same proportion, but more brief and intense in the conversion cases.

That which was uppermost in consciousness at the critical moment in conversion was described in these terms, given in the order of frequency: Sudden awakening, the sense of forgiveness, the sense of oneness with God, public confession, self-surrender, divine aid, and determination. The first of these, spontaneous awakenings, is the same thing in an exaggerated form which we have found so common in adolescence. The sense of oneness with God we saw to be one of the most common results of gradual growth. When present in conversion it may signify an anticipation of the experiences which usually follow the change of heart. Self-surrender and determination were two of the ways by which the adolescent entered into a positive religious experience. The sense of forgiveness, divine aid and public confession do not appear often in gradual growth. It is to be expected that during the intense ex-

periences of conversion there should be a greater tendency to objectify and personify the psychic influence at work. And there seems to be no reason for interpreting these three items as indicating any real difference between conversion and gradual growth.

In Table XVI the ideals of the female conversion subjects are reduced to the same scale as those of the gradual growth cases, for the purpose of comparing them. There were too few males who answered the question to tabulate. They show very few differences; and some of these are, perhaps, explained by the fact that the conversion subjects were not so old, generally, as the other class. It will be seen, at a glance, that the several items representing the ideals stand in about the same relative proportion, and that they bear the same analysis as that given under the ideals of the gradual growth cases. In short, we see that, judged by the feelings in early adolescence, the essential elements involved in entering the higher life, and the trend of life after entering upon active religious experience, the conversion and gradual growth have many likenesses and few differences. They appear to be slightly different ways of attaining the same end—that is, unselfish sympathy and coöperation, appreciation from within of the worth of religion, and the sense of harmony with and participation in the spiritual life of the world.

If the ends reached by conversion and the less violent process of growth are the same, it is worth our while, then, to ask wherein the real difference lies. In the first place it is clear that the difference is frequently simply that of terminology. We saw that spontaneous awakenings are a very common experience, and that persons familiar with the customary revival methods will describe an awakening as a conversion, while others mention similar experiences as simply an event in the normal course of development. These phenomena are the ones which usually follow what was called the sense of incompleteness, and should be carefully distinguished from conversion proper and from the process of gradual growth, which is marked by doubt, estrangement and reconstruction of faith.

It is in regard to these latter cases that the difficulty comes of finding their relation. Since the accompanying phenomena, the essential processes involved, and the results are similar, we are doubtless safe in saying that conversion is a condensed form of adolescent development. Society seems to have unconsciously recognized the ends to be attained by religious growth, and to have embodied them in the rites of confirmation and conversion. Even among savage races there are the corresponding customs at puberty or soon afterward, of knocking out the teeth, tattooing, circumcision, changing the form of dress, and the like.¹ The essential purpose of all these customs is the initiation of the child into manhood. There is strong evidence, we have seen, that the convert reaches, in some measure, the quality of life that he might have reached by gradually maturing. The method which society uses is to bring into sharp contrast the little world of self in which he has been living and the ideal of love into which he must enter. It brings together all the habits and desires of his former life, which tend to conserve his selfhood, and lumps them as "sin," which he must once for all renounce. It sets in contrast the ideal of perfect goodness, infinite love and complete happiness through self-sacrifice, which are yet far out of reach, but which, through faith, can be attained. It pictures the fatal consequence of his

¹Daniels: "A Study of Regeneration," this JOURNAL, Vol. VI.

present course, and the possible well being to himself and his kind if he turn his course. The power of public opinion is brought to bear to increase the strain. The force of his emotional nature is brought into activity through eloquence and the rhythm and harmony of music. He once for all renounces his little self and pitches his tent beneath the stars. He passes from his own narrow sphere and becomes a citizen of the world. His ideas converge into an ideal. His feelings are called into play, and he loves and trusts this ideal, and strives toward it. The secret of the realization of this new quality of life may be found in part in the *attitude* of the person. He becomes *professedly* what he aspires to be. "What we long for, that we are for one transcendent moment." He is in a receptive attitude toward all the higher influences about him. At first all the lines of his interest converged in himself; now his life is open Godward. What perfections he has not actually attained are, in a true sense, his sure possession because his course is turned in their direction.

But who can tell what actually transpires in one's consciousness when he turns seriously into communion with his deeper self? Turning to our crude analogy of nerve cells and their connections, which we know to be involved in the character and quality of thinking and feeling, we may get a definite picture, at whatever cost of accuracy. Granting that the highest consciousness is conditioned by the most highly and perfectly organized nervous system, that new ideas involve the functioning of new nerve elements, and that internal and external conditions help to determine these, it is conceivable that during the intense experiences attending conversion, under the heat of the emotional pressure brought to bear, a harmony is struck among these elements which might have taken months or even years to accomplish if one had been left helpless to grope in doubt and uncertainty. The analysis of the cases before us bears out, from the psychic side, this hypothesis, and shows that conversion is to some extent an anticipation of the direction of adolescent development.

The inferences that come directly out of the facts before us, and may increase our wisdom in religious education and in methods of religious work, are so important that they demand a word. One who has followed through the preceding pages will be impressed first of all by the *necessity of using individual methods*. One can scarcely think of a single pedagogical rule in regard to religious training after the end of childhood which might not violate the deepest needs of the person whom it is the purpose to help. The first demand is that the teacher or spiritual leader shall know something of the case he is to deal with,—his training, his temperament and the present trend of his life. It requires careful reading into human nature to know what a person needs and is ripe for; the magic stroke which is to change a child into a man; to know whether he only needs a hazy mind clarified and a struggling spirit calmed, or whether there is a distorted attitude of life which should violently be forsaken; to be certain that the threads of dawning consciousness are being skillfully knit and the tension of feeling symmetrically strung, to set the new life going in the right direction, and tune it to every virtue; to know first of all whether the course of life is not already wisely directed, and gravitating surely and steadily toward what seems to be the goal of spiritual attainment. There is no doubt that the salvation of many a youth who has stuck in the slough of despond, and the conservation of his life-force, is to set him to work, to call out his activities along definite lines, to breathe health and vigor—even physical health—into his nature, to help him feel

the power of the "everlasting yea." Still, we must have patience. Many another may be hopelessly dwarfed if hurried away from seriously facing the doubts that press in on him; may miss the strength and depth and poise that are often professed to have been a sure result of adolescent striving; may be tempted to make a cowardly escape along some narrow course of life, instead of waiting for that revelation which shall fill the whole round of life and call into activity a complete spiritual personality.

A knowledge of the stages of growth will help to escape many of the usual pitfalls in religious education. To be artificially accurate for the sake of clearness we have: Childhood, the seed time, up to 12 or 13; the beginning of youth, the time of germination, in which new life comes in a great wave, at 14 or 15, and its two wavelets, just before and just after the large one; next, youth, the growing time, in which the life forces are being sifted, readjusted and combined; by 24 or 25 the person has worked out a point of view, an individual insight, and has become a positive factor in the religious life of the world. Each stage should be a preparation for the next, so that the person may merge naturally and evenly into a strong, beautiful, spiritual manhood or womanhood.

Another highly desirable thing is that we take into account the different *lines* of growth. Among our Christian churches we have three pretty distinct ideals held up as to the true means of entering the spiritual life. A few denominations emphasize the fact of sin, set against it that of salvation, and insist on a definite, decisive, and more or less momentary change of life. Its ideal is that of *conversion* proper. Another group of denominations have recognized the likelihood of the burst of new life at the beginning of adolescence; they take means to cultivate it, and have established the rite of *confirmation*, which symbolizes the entrance into the new life. The ceremony of confirmation means to take advantage of what we have termed "*spontaneous awakenings*," and in the conversion study was pointed out as following the "*sense of incompleteness*." Still a third group of churches hold to the idea that the religious life, as the mental and physical, is a gradual development, and that alone, and have no ceremony to bring about or symbolize the birth into the new life. We have seen in our study that gradual growth experiences usually reach about the same end as the sudden and violent ones. The imperative fact for us here is that all of these three types of growth occur somewhat indiscriminately among the churches holding the three ideals. Certain denominations have caught up and emphasized one aspect of growth, and overlooked others which seem natural and fundamental. The highest results cannot come until organized religious forms seek out nature's way, which is God's, in religious growth, and become so plastic that they can adapt themselves to the laws of the spiritual life which are shown to us through study and experience. To contribute its mite in thus furthering the interests of the spiritual life is the purpose of this research. If a few earnest people coöperate along these lines at the present time as students and subjects, it is possible in the near future to work a higher wisdom over into a deeper religious life.

OBSERVATIONS ON NEWLY HATCHED CHICKS.

BY HATTIE E. HUNT.

The following record of observations, while it contributes nothing very new, may at least show how easy it is to make a beginning in the first-hand study of comparative psychology, and what interesting facts lie upon the surface. All the observations were made in the intervals of active teaching, away from home, and within the necessary limitations of a boarding house:—

The two chickens, Yellow and Black, were hatched March 29, 1897, and came under my charge the following day.

Second day.—At noon gave them meal mixed with water, which they would not eat. Gave them cracker crumbs. They did not know where to look for the food, but if the crumbs were let fall on the paper they would find them. They peck at each other's bills and eyes. Fed them hard boiled eggs, which they liked. When covered with the hand Y. will press up against the hand quite hard. Y. moved as if trying to fly. Offered them some water in a spoon. B. backs away and peeps with alarm. Y. is not afraid. Chase each other for food. Y. eats more than B., and seems the stronger of the two. Y. gives a contented little peep at every crumb he picks up. During their eating in the afternoon B. stood up and gave a cry of alarm, but stopped as soon as I spoke to him. This was repeated twice. Y. accidentally picked into the saucer of water, and the third time took a sip, raising his head to swallow. B. did not find the water, and would not drink when his bill was dipped into it. As soon as they have eaten enough they drop asleep standing. They are covered with a flannel cloth. B. raised his left foot and closed the toes once. Weak and unsteady on their feet. Will follow my hand wherever I move it.

Third day.—Fed them hard-boiled eggs. During their feeding I coughed, and both chickens crunched down to the floor instantly and remained motionless for several seconds. Do not peck at each other's eyes, but try to get food from each other. They know their food as soon as it is given. They prefer the white part of the egg. The crumbs of food that they shake from their bills seem to attract their attention. They will run a foot to pick them up. In the afternoon, when they were hungry, I fed them some cracker soaked in quinine and dyed red. Y. tasted it three times, but would not eat it. B. tasted it twice, and would not eat it.

Fourth day.—Gave them the red cracker soaked in quinine again. Y. would not touch it. B. tasted it once, and would not try it again. Y. scratches his head with one foot, but cannot balance himself very well while doing so. The chickens that belong to the brood from which these chickens were taken are now "scratching" like the old hen. I do not know when they began to do so. Gave the chickens gravel.

Sixth day.—Y. "scratched" for the first time. The paper on which they are kept was wet, and he scratched the wet spot, which was in the sunshine. B. sat down in the sunshine and made the motion that hens do in throwing dust over their backs. They are very sensitive to noise. The least stir will waken them. They stand in the sun and go to sleep, and then sit, or rather fall down

onto the floor. They sometimes sleep lying on the side. In the afternoon I repeated the experiment with the red cracker and quinine. Both were alarmed, and B. gave notes of warning. Soon they would walk around and over the cracker, but would not taste it. Gave the chickens a small dish of gravel.

Seventh day.—Y. "scratched" when he stepped onto the dish of gravel. B. has not been observed to scratch yet. Later, Y. scratched with each foot successively, and then pecked as though there were food there. When out of the box Y. takes little runs. An unexpected sneeze made both chickens run and hide. Later, B. scratched on the wet paper twice. Y. sometimes runs backward. The tendency to follow my hand is not so strong. When B. scratches a tremor seems to seize the foot, moving it so fast that one can scarcely see it, but not making a very definite impression on the place he scratched. Scratching alternately with both feet developed later, as also scratching and then pecking.

Eighth day.—Y. can nearly jump out of the box. When Y. is out of the box he will raise his wings and run for several feet. Have seen no other indication of playfulness. Both scratch and peck on a paper where there is nothing but printing. The scratching is more definite.

Ninth day.—Had a glorious time scratching in a saucer of water. The saucer had a rough surface. B. jumps up to the top of the box, and holds on with his bill while he tries to put his feet up. Finally succeeds and gets out of the box. Y. jumped out of the box in the afternoon. Gave the chickens a piece of strawberry that was red like the cracker, but they would not touch it, even though there was no quinine on it. Were afraid of it. Similar for cranberry. B. was more afraid than Y.

Tenth day.—Y. jumped out of the box, and kept doing so as fast as I could put him back into the box again. He kept this up until I covered the box, and then would spring for the top as soon as I took the cover off. B. tries to crowd under Y. to make Y. brood him.

Eleventh day.—One made the low note of warning like an old hen when a noise was heard in the hall. On my sneezing Y. ran to a chair leg, and B. ran in the opposite direction, both crouching down motionless for a few seconds. When one is taken away the other is much distressed. I shook a few drops of ink on the paper where they were feeding. Y. ran to the drops, pecked at them, then scratched them and pecked them. Then he went away for a time, but returned again, and scratched and pecked the spots. He returned to the spots and did the same thing four times.

Put a small hand-glass on the floor, standing it against my foot. Both were alarmed at seeing themselves in the glass; Y. much more so than B., who soon came near and looked at himself. Whenever Y. came near enough to see himself he would stretch out his neck and bristle up like a rooster fighting another. After a time he began to peck at the sides of the glass, and finally began to walk past and try to crowd into the glass (or into what might have seemed an opening to them). Both did this several times, but Y. continued his investigations for some time. As he walked past the glass he would look into the glass and try to crowd in, but when he got past the glass he would look all around in a surprised way, then would try it again. Finally, in coming to the end once, he walked around behind the glass, looked all about, then went away. A few minutes later both came up in front of the glass, and were afraid of the chickens in the glass. Later, Y. came back and investigated the glass again in the way already described.

Twelfth day.—Put a live earth-worm in the box. B. picked it up, but dropped it with a cry of alarm. Y. then grabbed it and tried to jump out of the box. I took both out of the box, and B. chased Y. for the worm, but Y. soon swallowed it. Later I gave them three worms. Y. was glad to get them, but B. was afraid, and could only be coaxed to eat a dead one. I put quinine on one worm, but Y. swallowed it immediately.

At this stage the chickens were taken back to the hen, and the following observations made: The chickens were placed under the hen at night. In the morning they were very glad to get away because the hen pecked at them. They ran to a fence ten feet away, where they stayed by themselves, scratching and picking the gravel incessantly. They would make friends with none of the other chickens. When the hen called they were afraid and ran away. On the fifteenth day some red apple peelings were thrown to them, but they looked at them, gave a note of alarm and ran away. When the apple skins were placed with the white side up the chickens would eat the pulp. They were taken to the kitchen for warmth, where they saw a cat. They were much frightened at the cat, and ran and hid. Later, when the fire was out and the room cold, B. accidentally came in contact with the cat as she lay asleep on the floor. This at first alarmed the chicken, but as the cat did not stir B. finally cuddled down for a warm sleep. Y. watched B. for a time, and then joined B. in his cozy quarters.

Sixteenth day.—On account of an accident to B., which made him lame and sick, both the chickens were put into a box behind the stove. Y. would go away from the box, but would return every few minutes and jump into the box, walk all around B., softly peeping all the while. In the afternoon B. was better, so that he could hop about in the box and pick up crumbs. Y. stayed out of the box the greater part of the time, but every time that B. peeped for him he would run to the box, hop in, stay a little while and then go away again. Later the two chickens were put with a brood just hatched, and became quite attached to the hen and chickens.

General remarks.—Y. is larger and stronger than B. Y. was more curious or observing, and less timid. They had quite an extensive vocabulary. Their notes were found to be quite different from those of the brood; being very similar to the sparrows, whose voices they may have heard at the windows. Their various notes expressed hunger, discomfort, curiosity, warning, fear, scolding and comfort. They carried on a steady "conversation" for the greater part of their waking hours.

Subsequently, four other chickens were observed in much the same way that Y. and B. were studied. Two of these chickens were kept on gravel, and the other two had paper in the bottom of the box. During the afternoon of the second day one of the chickens on the gravel was observed to make a spasmotic movement with one leg, almost like scratching, but did not scratch. On the fourth day he did scratch. Both the chickens on the gravel scratched before those on the paper did. The experiment with the quinine had the same result as with the other chickens. One taste of the mixture was enough to associate the bitter taste with the red color, and none of them would touch anything red again. On the sixth day each of the four jumped from the window-sill to the floor, a distance of sixteen inches. Two of them would jump a distance of twenty-nine inches, but the other two would not jump this distance. One would jump from the desk to the floor, a distance of forty-seven inches, but would not jump a distance of fifty-nine inches.

PSYCHOLOGICAL LITERATURE.

- (1) *Influence of Acute Alcohol Poisoning on Nerve Cells.* COLIN C. STEWART. The Journal of Experimental Medicine, Vol. 1, pp. 223-29. Plate XXVI, 12 colored Figs.

The experiments were undertaken with the purpose of testing the results obtained recently in this field by Dehio, Berkley and others. They were conducted as follows: Of three adult male cats one was kept in an alcoholic stupor (by intra-abdominal injection of 40% alcohol in 0.6% salt solution) for 5½ hours, being killed at the end of this time by an overdose of alcohol; the second was killed by an overdose in 50 minutes; the third was decapitated. From the cats, thus dead at the same time, equal sized pieces of different parts of the nervous system, spinal cord and ganglia, cerebellum and cerebrum, were cut out from corresponding localities, and all placed in the same dishes of the hardening reagents (absolute alcohol and the osmic-bichromate mixture) of the quick Golgi method. No confirmation of Berkley's results, moniliform swellings of the dendrites with degeneration of their contact granules, fragmentation of cell-body, etc., was obtained. It should be stated, however, that Berkley's work was done with chronic alcoholic material. The specimens hardened in alcohol were stained by the methylene blue method and furnished the strongest possible confirmation of Dehio's general result. All the sections to be compared were stained together in the same dishes throughout the whole process. The difference between the three animals in the depth to which the tissue from each was stained was so striking that it could be easily observed with the unaided eye. This difference in color tone is well shown in the plate, together with the microscopical appearance of the cells. Cells from the alcoholic animal (5½ hours) stain very lightly; they stain somewhat more darkly in the animal killed in 50 minutes, and are normally dense in the normal animal. Not all the cells, especially of the cerebellum and spinal chord, are equally affected, but a significant fact is noted in this respect in different regions. By using the cells in the figure as a color scale, practically all the cells of the cerebrum correspond uniformly with the scale, *i. e.*, very light for the first alcoholic animal, a little darker in the second, and dark in the normal animal. In the cerebellum not so many cells are affected to such an extreme degree, and among the large cells of the spinal cord comparatively few are affected. Cell bodies are a little larger in the normal animal. Measurements of the nuclei were impossible on account of heavy granulation of protoplasm in the normal (Purkinji cells), but were respectively 11.25 and 13.15 micra for the first and second alcoholic cats. Nucleoli appear very small in the alcohol animals, measurements in micra being as follows for the three animals: Normal, 2.94 μ ; alcoholic (50 minutes), 2.85 μ ; alcoholic (5½ hours), 2.76 μ .

The paper confines itself to experimental results, and makes no attempt at their interpretation as yet. It is of importance, however, to note that somewhat similar appearances have been demonstrated in the fatigue of the nerve cell, as worked out by the same method.

- (2) *I Cambiamenti Microscopici delle Cellule Nerrose nella loro Attività funzionale e sotto l'Azione di Agenti Stimolanti e Distruttori.* GIAMBATTISTA VALENZA. Napoli, 1896. Pp. 54. Plates I and II, 22 colored Figs.

This paper will be found especially valuable as a *résumé* of all that has been observed by way of changes in nerve cells under physiological and pathological conditions. For his experiments with electrical stimulation the author used the electric lobe of *Torpedo marmorata* and *ocellata*, stimulating the surface directly. The current was obtained from four large Bunsen cells, the stimulation being obtained from the secondary of a "grande" Du Bois-Reymond coil. The position of the secondary coil, the strength of current, frequency of shocks are only indicated indefinitely, "alta tensione e grande frequenza," "media tensione e media frequenza," etc., which not only makes confirmation of his experiments impossible, but renders comparison of his results with those of others inexact. He obtains a shrinkage of the nucleus, with increase of chromatin toward the centre close to the electrodes, accompanied with irregularity of contour. Farther from the electrodes the nuclei become turgid with their chromatin arranged about the periphery. Valenza is unable to confirm any of the observations which claim to prove mitotic division of nerve cells, indications of division being confined to the ependyma, when they occur. For his destructions he used a red-hot iron, and as a result he obtains some peculiar pictures, fusion of nerve cells, fragmentation of nuclei which simulate mitotic figures, etc. In any such procedure, it is impossible to interpret the results. They may be phenomena of simple steam explosion, heat coagulation, interference with nutrition, poisoning with decomposition products, etc., etc., and certainly throw light only upon similar procedures of other experimenters, and none on the normal or pathological processes which go on in nerve cells. Figure 19 shows two nerve cells from an animal killed by injection of strychnine. In one of the cells the nucleolus is situated in the centre of the nucleus. In the other the drawing and text indicate that it has migrated out into the protoplasm. I have observed many such in my own specimens, and in every case have been able to find evidence that they were simply dragged out of their normal position by the edge of the section knife. We miss throughout the paper any adequate consideration of normal control material.

C. F. H.

- (3) *La plasticité Morphologique des Neurones Cérébraux.* DR. JEAN DEMOOR. Arch. de Biologie, XIV, 1896.

In studying the general subject of the plasticity of nerve cells DeMoer has observed a diminution of chromatin in the cells of the cortical visual centres, as a result of thirty minutes' normal function, and, after some time, irregularities in the nucleus and general decrease in the size of the cell. But it is to his other experimental work that special interest attaches. Subcutaneous injection of morphine in dogs has given moniliform swellings of the protoplasmic processes of the cortical cells, recalling those described by Berkley and Andriezen for chronic alcoholism. Even the axis

cylinder is at times affected. Intravenous injection of chloral-hydrate, and complete chloroform narcosis, are accompanied by the same changes, though, in the case of chloral, of less degree. Stimulation of motor areas with an interrupted current has produced also beading of the cell fibrils, with shrinkage of the cell, and a change to a more or less globular shape.

The relation of the whole question to the present theories of contact of cells in function, and possibly also to the phenomena of fatigue, over-exertion and sleep, is pointed out by the author.

COLIN C. STEWART.

(4) *Psychology of the Moral Self.* By B. BOSANQUET. London, Macmillan & Co., 1897, pp. viii+132.

In this work Mr. Bosanquet treats of modern psychological conceptions in their bearing upon ethical problems, with special reference to the modern doctrines of apperception and 'vital series.' In its more psychological aspect the book has two main theses: (1) mind is continuous, not discrete, as the atomism of the associationists would have it, or, more accurately, as the neo-Hegelians represent the associationists to hold; (2) mind on its intellectual side can all be expressed in terms of identity and difference, and has resulted from the differentiation of an original unity into the diversity of present experience.

These principles find concrete form in the definitions of processes. Perception, e. g., is defined as 'the blending of ideal elements by identity, with the objective presentation after the two have passed through a thorough opposition to each other.' 'This blending through identity of points in the contents means a judgment.' Space and time arise when 'experience has enabled us to differentiate them out of the original vague continuum' and the 'essence of their perception depends on the formation within the psychical continuum of groups that have phases.' The explanation of assimilation, discrimination and apperception follows Mr. Stout very closely in the doctrine of 'vital series' and the formation of systems, but they are finally brought under the universal category of identity and difference in the sentence, 'All cognition is identity asserting itself.'

A most ingenious combination of modern psychological doctrines with the Hegelian standpoint is to be found in the two chapters on volition, and the one entitled Reasonable Action. The ideo-motor theory of volition is accepted in its entirety, and is stated in the general principle that ideas tend to realize themselves in action. Viewed in the large, volition is a realization of the self. Now the self is not an abstract unrelated entity, but a system of ideas, many of which have reference to others, so that in realizing itself the individual works at once for its own good and the good of the community at large—is at once egoistic and altruistic without being aware of the distinction. Reasonable action is defined to be 'action' in accordance with the whole systematized self or experience. Stated in Hegelian language it becomes 'the actual identification of the private self with the universal self, the actual surrender of the will to the greater will of the system to which we belong.' In the concluding chapter on Body and Soul the same tendency is shown. All other current views of the relation are rejected in favor of the one that makes the mind the ideality of the body. The puzzle has arisen from hypostatizing the two abstractions, mind and matter. To solve the problem we must go back to the given, which is at once subjective and objective. The position re-

minds one forcibly of Wundt's principle that the datum of experience is both physical and psychical.

In spite of its many interesting features the work as a whole is disappointing. One feels constantly that any views which supplement current theory belong rather to a metaphysics than to a psychology of morals. We are at once impressed with the fact that neo-Hegelianism has more to give psychology in helping to frame a point of view than many had supposed, but that to adopt its methods of thought would be disastrous to the science.

The exposition is involved and at times illogical. Conclusions are hinted at rather than stated, and the arguments abound in ellipses which are hard to fill. Aside from these imperfections of form the difficulties of the reader are increased by the curious way in which the author presupposes a knowledge of metaphysics, when he is expounding the most familiar psychological theories with great minuteness. It will never be a popular book, and contains little that is new for the specialist.

W. B. PILLSBURY.

BOOK NOTES.¹

(G. S. H.)

- (5) *Buddhism in Translation.* By HENRY CLARKE WARREN. Cambridge, Mass., 1895, pp. 520.

This is the third in the Harvard Oriental Series edited by Prof. C. R. Lanman, and consists of translations of carefully chosen Pali texts illustrating the chief tenets of Buddha, including sentient existence, Karma, Nirvana, and the religious orders.

- (6) *Theory of Thought and Knowledge.* By BORDEN P. BOWNE, Professor of Philosophy in Boston University. N. Y., Harper & Bros., 1897, pp. 389.

"The root thought of the work is that thought is an organic activity which unfolds from within, and can never be put together mechanically from without. Persons on the sense plane perpetually seek to build up thought from without by the mechanical juxtaposition and association of sense impressions. This is the perennial source of that unthinking thinking which tends to deprive thought of all authority and finally to dissolve it into a shadow of physical mechanism." This is a serious, able, logical work, showing great growth in range and vigor of thought since the author's last publication, and with none of the old contempt for those whose preponderating interest inclines them to approach philosophical problems from other standpoints. It is the best introduction we know to the problem, "What should we think about reality?"

- (7) *The Will to Believe, and Other Essays in Popular Philosophy.* By WILLIAM JAMES. Longmans, Green & Co., N. Y., 1897, pp. 332.

It is good to have the chief papers and lectures since 1880 of the most brilliant and literary of American psychologists brought together in a tasteful volume. The humor of "On Some Hegelism," the pathos of "Is Life Worth Living?" the symbolic relation of

¹ Notice under this heading does not preclude a fuller review later.

"Reflex Action and Theism," the intensely Carlylean style of "The Dilemma of Determinism," and of frequent hortatory passages in other papers, the suggestion of "The Sentiment of Rationality," and the ethical fervor of "The Moral Philosophy and the Moral Life," the old and the new alike are as stimulating and appetizing reading as can anywhere be found. Dr. James is essentially an essayist and his peculiar excellence is hardly less apparent in these papers than in the chapters of his psychology.

- (8) *The Sacred Tree, or The Tree in Religion and Myth.* By MRS. J. H. PHILPOT. London, Macmillan & Co., 1897, pp. 179.

This is a diligent, well arranged and most fascinating treatment of its topic, covering a vast range of facts from folklore and primitive religion, and at every point suggests the standard and almost monumental work of Mannhardt on "Baumkultus und Feldkunde." Topical treatises on special theories of folklore like this suggest grave questions in mythology sure to arise later. Meanwhile we may enjoy them to the full.

- (9) *Die Religion Jesu, und der Glaube am Christus.* Von Lic. Th. M. SCHUIZE Halle, 1897, pp. 77.

This little monograph urges that Jesus was the only theodicy, that his birth, life and resurrection are unique, and belief in these is indispensable to being religious at all, and in general represents a small group of young Germans who seek to stem the tide of higher criticism, Ritsehism, etc., and lead a modified tractarian reaction in Germany, but who show almost entire lack of psychological insight and depth.

- (10) *Die Naturwissenschaft in ihrem Schuldverhältnis zum Christentum.* Von Lic. Th. M. LARSEN. Berlin, 1897, pp. 90.

Paradoxical though it seems, natural science owes its origin to Christianity. The chief events and doctrines in the history of Christianity are very briefly passed in review with a purpose almost the opposite at every point of that seen in Pres. A. D. White's recent work. The harmonies between religion and science and the many essential points in which religion has positively contributed to the scientific spirit and work are dwelt on.

- (11) *Recent Advances in Theistic Philosophy of Religion.* By JAMES LINDSAY. Blackwood & Sons, Edinburgh, 1896, pp. 547.

This is far more than an amplification of the author's earlier little work, *The Progressiveness of Modern Christian Thought*. The basal truth of all religion is theism, and this is distinctly advancing. The theology of nature, God, and man, are the three chief divisions of the book. The style in which the argument is presented is clear, forcible, and often poetic; the standpoint is distinctly progressive, but never radical.

- (12) *Religions of Primitive Peoples.* By D. G. BRINTON. G. P. Putnam's Sons, New York, 1897, pp. 264.

This book is in the second series, 1896-7, of American Lectures on the History of Religion, and treats methods of study, origin and content, expression in word, in object, in rite, and lines of development. As a whole it is a fresh and comprehensive summary of the general points of view from which Dr. Brinton's valuable and voluminous work in the past has been done.

- (13) *Life and Immortality, or Soul in Plants and Animals.* By THOMAS G. GENTRY, Sc. D. Philadelphia, 1897, pp. 489.

This is a badly printed book with 75 cuts and more than half as many chapters, each devoted to one species of insect, fish, beast, or bird, by a devoted lover of animal life of the old field naturalist type, who claims for the lower animals a higher status than is generally attributed to them, and believes they have a future life where they will receive a just compensation for the sufferings which so many of them have to undergo in this world. This is largely due to man's cruelty, which grows out of his too exalted opinion of himself. The doctrine of immortality for animals, the author hopes, will lead to a more humane treatment.

- (14) *Quel est le point de vue le plus complet du Monde; Quels sont les principes de la Raison Universelle?* Par H. LAGRÉSILLE. Paris, 1897, pp. 135.

In these two essays the author argues that reason can not do its work in any final form till it can start from the monad-atom, on absolute unity as the most elementary factor of construction. This atom must have some primordial power of orientation and auto-rotation. Man must reason, therefore universal reason exists and hence God is. It is as necessary that causes should be intelligent as that there should be causes.

- (15) *The Psychology of the Emotion.* By TH. RIBOT. Imported by Scribner's Sons, New York, 1897, pp. 455.

This is a translation of a work already briefly noticed in our pages, which every psychologist must and many others will read, and all educated and intelligent people would find interesting and practical.

- (16) *Darwin and After Darwin.* By the late GEO. J. ROMANES. III, Post Darwinian Questions. Isolation and Physiological Selection. Chicago, Open Court Pub. Co., 1897, pp. 181.

This volume contains the six concluding chapters of "Darwin and After Darwin," viz.: I and II, "Isolation;" III, "Physiological Selection;" IV, "Evidences of Physiological Selection;" V, "Further Evidences;" VI, "A Brief History of Isolation as a Factor in Organic Evolution." The portrait of John T. Gulick appears as a frontispiece, and his valuable contributions to the subject of isolation are sampled and digested in the appendix.

- (17) *Crime and Criminals.* By I. S. CHRISTISON, M. D. Chicago, W. T. Keener Co., 1897, pp. 117.

These chapters are brought together from a series of articles entitled "Jail Types," in the *Chicago Tribune*, last winter. The photographs, brain cuts, ears, etc., constitute a series of copious and interesting illustrations and the cases are in general so typical that while this booklet is very far indeed from being a treatise in criminology, it presents many of the most important points in a way suited to stimulate to further reading and thinking.

- (18) *Allgemeine Physiologie.* Von MAX VERWORN. Jena, 1897, pp. 606.

The first edition of this valuable treatise, now enlarged twenty-two pages and with twelve new cuts, has already been noticed in this JOURNAL as marking a most interesting, suggestive, and promising new departures in the direction of comparative physiology.

- (19) *Précis de Logique Évolutionniste.* Par P. REGNAUD. Paris, 1897, pp. 215.

The first part discusses the conditions of reason, signs, terminology and the proposition. The second part describes the categories, genus, species, quality, relation, and cause. Part four treats axioms, definition, reason, proof, law, analysis and syntax; the fourth amphibologies and verbal errors, as synonymy, homonyms, abridged formulas, etc., and the last part discusses fallacies.

- (20) *Geschichte des Neueren Deutschen Psychologie.* Von MAX DESSOIR. Berlin, 1897, pp. 356.

This is the second, enlarged and fully revised edition of the first half volume of the history of recent German psychology, beginning with Leibnitz and coming down to the year 1800. The first edition has already been noticed in this JOURNAL.

- (21) *La Sociologie.* Par AUGUSTE COMTE. Résumé par Emile Rigolet. Paris, 1897, pp. 772.

This digest of Comte's "Sociology" was greatly needed, and is well indexed and will prove of great convenience.

- (22) *Les Origines du Socialisme d'État en Allemagne.* Par CIR. ANDLER. Paris, 1897, pp. 495.

The authors treated are Hegel, Savigny, Gano, Lasalle, Rodbertus and Thünen, and right, wealth and reparation make the three parts of the book, each with many subdivisions, and a copious bibliography at the end.

- (23) *Neue Beiträge zur Psychologie des hysterischen Geisteszustandes.* Von DR. P. RONSBURG und DR. L. HAJÖS. Leipsic, 1897, pp. 131.

These studies were based on experiments on anaesthetic and amnesic patients, and led to the conclusion that amnesia are outer symptoms of the same psychic abnormality of which hysteria is a larger and more internal expression. The field of consciousness is indefinitely narrowed and association is restricted so that dual and morbid personalities arise.

- (24) *Bird Life.* By FRANK M. CHAPMAN. New York, Appleton & Co., 1897, pp. 269.

This is a guide to the study of our common birds, with seventy-five full-page plates and many text drawings by E. S. Thompson. The topics are: Place in nature and relation to man, Colors, Migrations, Voice and nesting season, Water and land birds.

- (25) *The Chances of Death, and Other Studies in Evolution.* By KARL PEARSON. 2 vols. E. Arnold, London, 1897, pp. 388 and 460.

The chief of these essays are: Scientific Aspects of Monte Carlo, Roulette, Reproductive Selection, Socialism and Natural Selection, Politics and Sermons, Women and Labor, Variations in Man and Woman, Woman as Witch, the German Passion Play, Kindred Group Marriage. The volumes are well illustrated, indexed and printed.

NOTES AND NEWS.

Dr. E. Meumann, late first assistant in Professor Wundt's laboratory at Leipsic, has been called to an assistant professorship in the University of Zurich.

A. R. Hill, Ph. D. (Cornell), succeeds Professor Wolfe at the University of Nebraska. The chair vacated by Professor Hill at the Oshkosh Normal School has been filled by the election of F. D. Sherman, Ph. D. (Leipsic).

S. F. McLennan, Ph. D. (Chicago), has been appointed Associate Professor of Psychology and Pedagogy in Oberlin College.

Dr. H. Zwaardemaker, well known by his classical work on the physiology and psychology of smell, has been made Professor of Physiology in the University of Utrecht.

C. E. Seashore, Ph. D. (Yale), has been called to an instructorship in experimental psychology in the University of Iowa, and Mr. J. P. Hylan takes a similar position at the University of Illinois.

Miss E. Muir, Ph. D. (Cornell), succeeds Miss Hamlin as Professor of Philosophy and Psychology in Mt. Holyoke College.

Mr. I. M. Bentley has been appointed Assistant in Psychology at Cornell University.

Professor W. Preyer died at Wiesbaden on July 15th. We have also to record the death of Professor Holmgren of the University of Upsala; Professor A. M. Mayer, of the Stevens Institute of Technology; and Dr. J. B. Luys, of the Paris Academy of Medicine: all of them men whose names are familiar to students of experimental psychology.

Competitors for the Welby prize are reminded that essays must reach Professor Titchener not later than Jan. 1st, 1898.

The psychological laboratory at University College, London, has acquired a good part of the apparatus used by Professor Münterberg in his Freiburg laboratory. Work opens this month, under the direction of Dr. W. H. R. Rivers.

A psychological laboratory, in charge of Dr. W. O. Krohn, late of the University of Illinois, has been opened at the Illinois Eastern Hospital, Hospital, Ill. A quarterly Bulletin (\$2.00 yearly) will be issued, containing psychological, pathological and neurological reports, records of clinical cases, and short summaries of current work in foreign languages. The Bulletin has examples set it in Professor Kraepelin's *Studien* and the *New York State Hospitals Bulletin*. If it follows in the lines laid down by these periodicals, it will do valuable service to the cause of psychology in general and mental pathology in particular.

A new journal, the *Rivista quindicinale di psicologia, psichiatria, neuropatologia*, has been established at Rome (Dr. Santo de Sanctis, Via Penitenzieri 13). Its acting editors are Professors E. Sciamanna and G. Sergi.

The meeting of the American Psychological Association will be held this year at Cornell University, Ithaca, the sessions beginning Dec. 28th. We hear with regret that Professor Baldwin, President of the Association, has been ordered by his physician to avoid public speaking, which will prevent the delivery of the presidential address in the customary form.

We print the following at the special request of Dr. Griffith: The American Pediatric Society is making a collective investigation of infantile scurvy as occurring in North America, and earnestly requests the coöperation of physicians, through their sending of reports of cases, whether these have already been published or not. No case will be used in such a way as to interfere with its subsequent publication by the observer. Blanks containing questions to be filled out will be furnished on application to any one of the committee. A final printed report of the investigation will be sent to those furnishing cases.

[Signed.]

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BOOKS RECEIVED.

- DURKHEIM. *Le Suicide, Étude de Sociologie.* Pp. xii-462. F. Alcan, Paris, 1897. Price, 7.50 fr.
- KÜLPE. *Introduction to Philosophy.* Translated from the German by W. B. Pillsbury and E. B. Titchener. The Macmillan Company, New York, 1897, pp. x-256. Price, \$1.60.
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SOME JUDGMENTS ON THE SIZE OF FAMILIAR OBJECTS.

By H. K. WOLFE.

Many curious errors in the reproduction of one magnitude in terms of another have long been known. How many city folks can tell in feet and inches the height of an average horse? How certainly the non-professional individual, who can estimate this object closely, will measure the height on himself! The weight of a carriage, the number of sheep, hogs or cattle in a drove, the height of a tree or a steeple, the apparent size of the moon; in all these problems the personal variation would probably be great, and of course would be much greater if the estimate were made on a memory image instead of from an immediate perception. How many persons who have seen the original of the Sistine Madonna can tell with much confidence whether the virgin is "life size"; or better, whether the figure is of average size, or is larger or smaller than the average woman? In nearly all the above cases the individual variations would tend to balance each other, so that a very great constant error would not be looked for.

In many familiar instances the constant error is considerable, as, for example, in attempting to indicate on the wall the distance from the floor which corresponds to the height of a silk hat, a doubling of the actual height is not infrequent. Distances of a mile or more in the city are generally underestimated and in the country overestimated; while in certain obvious cases this tendency would be increased and in other cases might be reversed.

Few persons would fail to underestimate the length of a horse's head, especially if asked to mark it off on the black-board or, as is the custom, on a barrel. Anyone unfamiliar with such instances may learn a valuable lesson in self-distrust by placing three silver dollars in a line just touching each other and then drawing away the middle dollar far enough to make the distance from it to each of the other dollars equal to the distance between the outer edges of the other two. Besides the usual explanation of illusions we have here to deal with the very uncertain factor of multiples of an unusual unit.

In these and other cases of immediate judgment of space relations, there are two quite distinct sources of error. One arises from the common illusion of space perception when the things to be compared are both present to the senses. No one ever *imagined any* illusions of the senses. So also no amount of reasoning will convince the practical, uninitiated man that his illusive perceptions are not true perceptions of real things. He must refer these stimuli to some objective standard which commands his belief, or he must neutralize the disturbing factors.

The other source of error is the neglect of uninteresting and useless details in complex presentations. The only interest we have in the height of a hat is relative to other hats. Height in inches, or as compared with that of a wall, is almost the least interesting fact regarding a hat. This knowledge is also useless. The abstraction of these commonly unused details from our memory pictures of familiar objects has been employed for illustrative purposes by psychologists of all times. As far as I know there has been no attempt at a quantitative analysis of the facts.

In connection with classes in the study of children it has been my custom for several years to spend some time in the public schools of Lincoln, Nebraska. One result of this work for the year 1893 is the data upon which this paper is based. The repetition of the exercise with successive classes in psychology supplements this material in a satisfactory manner.

I wished to know how accurately children and adults can reproduce the size of objects with which they are familiar, but which for the time are not present to the senses. A few other points were incidentally included in the investigation. In selecting objects there was encountered the difficulty of finding common things with a definite and constant size, which should be unknown in terms ordinarily used for measuring size. To ask for the dimensions of a common brick would be useless; for actual bricks differ considerably in size, and the standard size of a brick is known to many chil-

dren. Value is perhaps as loosely associated with size as any other concept, and our coins and bills are quite constant in form and dimensions. Money is also common enough to furnish a memory image to nearly all children who could be expected to give reliable results on a question involving the description of a memory picture.

I selected the following coins: dollar, half dollar, quarter dollar, dime and nickel; also the five-dollar bill. Few children have a very definite standard of length at command. Instead of asking for dimensions, the problem was to reproduce on paper the size and form of the object. The paper used was 14 x 9 inches in size. Altogether fourteen questions were given. The teachers were nearly all interested, and they aided not a little in securing honest, intelligent and prompt results.

The procedure was as follows: The pupils of a given room all worked at the same time. Each child was given a sheet of paper, and told to write his name, age and grade in the upper left-hand corner as the paper lay on the desk with the long side parallel to the long side of the desk. Just below his name near the left margin of the paper he was told to draw a circle the size of a silver dollar. A diagram of the paper was put on the blackboard, and the position of the dollar was indicated by a small cross. It was emphasized that size was more important than roundness. The pupils were told to correct their first attempt by erasure or by striking out parts of the curve whenever the circle seemed too large or too small. About one minute was given to this and to each of the other problems, though more time was given when desired. Just at the right of the dollar they were asked to draw a half dollar; at the right of that a quarter dollar, then a dime and a nickel. Only one problem was given at a time, yet the children were not prohibited from making corrections in the figures already drawn. (I do not think that such changes were made by *more* than five per cent. of the children.) The fractional coins were called for as above, and each time the number of cents was announced, so that the children could not be in doubt as to what was wanted.

After drawing the nickel the children were asked to draw a square equal in area to the sum of the areas of all the circles drawn. When necessary this was explained, and in all cases the statement was put in two or three forms. Just below the coins was drawn a figure equal in size and similar in form to a five-dollar bill (or to a one or two dollar bill). In the lower right-hand corner of the paper a circle three inches in diameter was drawn; in the lower left-hand corner a square one inch on a side, and between these an equilateral triangle

equal in area to the sum of the areas of the triangle and square. The length, width and diagonal of the paper in inches were then required. The equilateral triangle was not drawn by the children of the fourth grade.

The entire time in any one room seldom exceeded twenty minutes and never occupied less than fifteen minutes. As much personal supervision as possible was given by the teachers and myself, though, of course, without any suggestion as to the points involved in the investigation. I personally conducted the work in every room, and was assisted by the teacher in charge, and often by my pupils. All measurements of results and nearly all computations were made by myself. No results are omitted from the tables. The entire work in the schools was completed in as short a time as possible. It is not probable that any material difference in results was produced by practice or anticipation. Since I examined only two grades—the fourth and the eighth,—it was possible to complete the work in each building in one-half day. Assistance from previous information and from comparison with standards was thus reduced to a minimum. The results of the various problems are by no means of equal interest. It seems best, however, to present the facts obtained separately and in the order of the original problems. A table and summary of general conclusions may then follow.

I.

Reproduction of the Size of a Silver Dollar.

All circles were measured on two diameters parallel with the edges of the paper, unless a perceptibly better adjustment presented itself. Measurements were recorded to the nearest millimeter. But, since the two diameters were taken in immediate succession, it was possible to attain even greater accuracy by attention to compensation. This was made especially easy by the habit of measuring both diameters before recording the first.

The tables are, for the most part, self-explanatory. A few words concerning the methods of obtaining the average and the average variation may be useful. It is evident that the arithmetical mean or average of all judgments in a given class, when compared with the actual dimensions of the object, will indicate the direction and amount of the constant error. In most cases the constant error is so small that it did not seem necessary or even wise to emphasize it by separation from the average, since a larger number of experiments

might possibly have reversed it. In all cases it may easily be obtained directly from the tables.

The average variation is obtained, as usual, by subtracting each judgment from the average of all in a given class, adding the remainders without regarding algebraic signs, and dividing by the number of judgments. It is simply the average variation of separate judgments from the arithmetical mean of all judgments. The average variation is a fair measure of the relative appreciation of differences on the part of the pupils in various classes. It must not be confused with the average error, which in a somewhat similar manner measures the accuracy of judgment, but in the present investigation is less interesting.

TABLE I.
Silver Dollar = 37.8 mm.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	46	37.2	6.2	60	36.8	5.3
10	63	38.0	5.3	63	38.0	6.0
11	35	35.8	3.9	53	38.4	5.7
12	33	37.4	5.9	28	38.5	6.0
13	19	37.9	6.0	16	36.3	7.1
Average,		37.3	5.5		37.6	6.0

EIGHTH GRADE.

13	25	37.2	3.1	41	39.2	4.0
14	31	39.5	3.4	40	38.7	4.0
15	29	38.2	3.4	47	38.3	3.1
16	21	38.9	3.7	42	39.5	4.3
Average,		38.5	3.4		38.9	3.9

YEAR. PSYCHOLOGY CLASS.

1893	22	39.3	2.9	22	39.4	4.6
1894	30	41.2	6.0	42	41.4	4.6
1895	43	38.4	4.0	37	39.5	3.5
1896	53	39.1	4.3	33	38.5	3.2
1897	64	38.9	4.0	48	39.5	3.3
Average,		39.4	4.2		39.7	3.8

Table I shows that no appreciable constant error is made by children of the fourth grade in estimating the size of a silver dollar. There is no difference in the results that can be referred to difference in age. There is, however, a distinct though slight increase in the size of the circles as made by the eighth grade children. This increase is more marked in the case of the girls. The more advanced the children, the larger the dollar seems and the greater the error is. The same conclusion is also indicated by the results from university students. Indeed the tendency is even more strongly marked, as is shown by the lower part of the table. The fourth grade children, then, make the dollar about the proper size, and a decided tendency to overestimate its size is shown by the eighth grade pupils, and still more so by advanced university students. Although this tendency is unmistakable, the constant error is, on the whole, rather insignificant in itself. In connection with other measurements it has a deeper meaning.

In the columns marked average variation we observe considerable uniformity within each class and rather large differences between the classes. As might be expected the immature pupils of the fourth grade show the greatest variations from each other. Let us ascribe this to their ignorance. We shall then have to account for the contrary results of the eighth grade and university students by the development of individuality in the university classes.

We should hardly have expected the difference between boys and girls which this table shows. Yet it will be seen that the same result holds good throughout the present investigation, that is, *girls differ from each other more than boys do in their ideas of the size of such objects as are here studied.* If this fact shall be proved true generally, it may become of considerable pedagogic importance. Of course in this connection it merely means that the girls examined were in general inferior to the boys in ability to reproduce the sizes of the objects asked for. The apparent equality of the sexes in the general averages means that the sexes have practically the same constant errors in estimating the size of a dollar.

The university students are not as well able as children of the advanced grades to estimate the size of a silver dollar. Moreover they differ more from each other than do the children of the eighth grade. Beyond a certain very elementary stage general knowledge is not power in accurately reproducing the space dimensions now under consideration. The average variations of the men for the first two years seem abnormal. I am entirely unable to account for the peculiar

results exhibited. The men of the class of '94 seem to differ from each other extremely in all these tables. This is partly due to the presence in that class of three or four *large-hearted* fellows who do and see all things in a generous way. They also raised appreciably the average size of all the figures. It is not believed that mutual influence played any part in their judgments. There happened to be also two or three women in that same class who had exalted ideas of the size of coins. If these persons had been closely associated with each other,

II.

Reproduction of the Size of a Silver Half Dollar.

TABLE II.

Half Dollar = 30.6 mm.

FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	46	28.8	4.7	60	29.6	5.1
10	63	30.9	4.4	63	30.4	5.1
11	35	29.4	4.3	53	30.4	5.1
12	33	29.9	4.3	28	30.9	6.0
13	19	30.7	4.5	16	29.6	6.2
Average,		29.9	4.4		30.2	5.5

EIGHTH GRADE.

13	25	30.8	2.2	41	32.0	3.2
14	31	31.5	2.7	40	31.1	3.6
15	29	30.2	3.1	47	31.0	2.9
16	21	30.1	2.7	42	32.0	3.7
Average,		30.9	2.7		31.5	3.3

YEAR.

PSYCHOLOGY CLASS.

1893	22	31.9	3.2	22	32.1	3.5
1894	30	33.5	4.5	42	34.1	3.5
1895	43	31.2	3.5	37	32.4	3.0
1896	53	31.9	3.5	33	31.7	3.2
1897	64	31.2	3.3	48	31.8	3.0
Average,		31.9	3.6		32.4	3.2

I should accept the result as an indication of collusion. They were not intimate, and in nearly every case were the last persons of the whole class to suspect of any unfairness. In later classes nearly as extreme judgments occur, but in all other classes such errors are proportionally fewer.

Almost exactly the same characteristics are to be observed of the half dollar that were noticed in the case of the dollar, especially the near approach of the averages to the actual size of the coin, and the smaller averages of the fourth grade pupils, in this table somewhat under the actual size. We note also the approximate equality of constant errors between the sexes, the slight difference resulting from the greater size of the circles made by the girls. As in Table I there is seen little effect due to age within the same grade, but we observe the clearly marked influence of school training in the larger differences between the lower and higher grades.

The average variation also shows the same relative results as in case of the dollar. It is, however, noticeably less, and perhaps the difference in favor of the boys in the fourth and eighth grades is even greater, though as in Table I the women of the psychology class show a smaller average variation than the men. I would call especial attention to the regularity of this average variation in case of the boys of the fourth grade. For the small number of boys and their small progress in school knowledge this regularity forms an excellent example of the presence of law and of the possibilities of such investigations.

We see in this table the same low average variation of the boys of the eighth grade, which doubtless has a constant cause. It is possible that this means, in connection with the greater variations for lower and higher grades, that, at this period of life and stage of advancement, the advantage of knowledge and experience is at a maximum, and that individuality has not yet strongly manifested itself. But we must beware of generalization from so few facts. This warning applies especially to the apparently clear indication that girls are brighter than boys, inasmuch as the effect of general training is to increase the size of the figure, and the tables show that girls regularly make larger figures than those made by boys.

III.

Reproduction of the Size of a Silver Quarter Dollar.

In reproducing the quarter dollar the constant error almost disappears. The lower grades make the circle just a little too small and the university classes make it a little too large.

The relations of the averages to each other are almost exactly the same in kind as in Tables I and II. In amount the differences between the various classes are less than in the preceding.

TABLE III.
Quarter Dollar = 24 mm.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	46	22.5	3.3	60	23.5	3.7
10	63	23.6	3.4	63	23.6	3.6
11	35	23.1	4.1	53	23.7	4.0
12	33	22.5	3.9	28	25.3	4.5
13	19	23.3	3.0	16	23.9	4.6
Average,		23.0	3.5		24.0	4.1

EIGHTH GRADE.

13	25	23.3	2.0	41	24.7	2.4
14	31	23.4	2.5	40	23.8	2.5
15	29	23.1	2.7	47	24.4	2.3
16	21	22.9	2.9	42	24.7	3.1
Average,		23.2	2.5		24.4	2.6

YEAR.	PSYCHOLOGY CLASS.					
1893	22	24.2	2.2	22	25.1	2.2
1894	29	26.2	3.4	42	26.4	2.4
1895	43	23.8	2.8	37	24.6	2.3
1896	53	24.6	2.6	33	24.6	2.8
1897	64	24.4	2.7	48	24.4	2.3
Average,		24.6	2.7		25.0	2.4

ing tables. The uniformity of the several groups within each large division is broken only by the class of '94 of university students, and by both men and women of this class.

The average variation has decreased considerably, even in relation to the size of the object. The relative difference between boys and girls has also decreased, and, as in Tables I and II, the men of the psychology class show a greater average variation than the women.

IV.

The Dime.

Since the two following tables of results (for the dime and nickel) show the reverse tendency, *i. e.*, an *underestimation* of the size, the question arises as to the effect of the first made circles on those coming after. It happens that the quarter was preceded and also followed by two other judgments of coins, and that those preceding were overestimated and those following were underestimated, while the quarter itself was judged about right. The discussion of this question is postponed until the evidence is all before us.

TABLE IV.
Dime = 19 mm.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average	Av. Variation		Average	Av. Variation.
9	46	13.8	2.3	60	14.9	2.2
10	63	14.7	2.2	63	14.6	2.3
11	35	14.9	2.5	53	15.1	2.4
12	33	14.6	2.3	28	15.3	1.9
13	19	14.3	2.1	16	14.6	2.0
Average,		14.5	2.3		14.9	2.2

EIGHTH GRADE.

13	25	15.2	1.7	41	15.5	1.6
14	31	14.9	1.7	40	14.5	1.8
15	29	14.5	1.4	47	15.7	1.6
16	21	14.9	1.6	42	15.0	1.6
Average,		14.9	1.6		15.2	1.7

YEAR. PSYCHOLOGY CLASS.

1893	22	15.0	1.8	22	15.5	1.3
1894	30	16.9	2.4	42	16.1	1.8
1895	43	15.5	1.9	37	15.3	1.4
1896	53	15.5	2.1	33	15.5	1.6
1897	64	15.6	2.0	48	15.7	1.5
Average,		15.7	2.0		15.6	1.5

In estimating the size of a dime the observers for the first time lose their bearings. The constant error here claims our immediate attention by its enormous and unexpected size. The discrepancy between the real and the represented area will provoke the speculative mind to all sorts of explanations. The first naturally to suggest itself is the fact that, beginning with a larger circle, the dollar, the others are made in relation to those preceding, and hence the later ones especially are influenced by the general law of relativity, that alongside of large objects the small seems smaller than it really is. However this may be, I have convinced myself that the tendency to make a silver ten-cent piece too small does not depend upon the presence or suggestion from the outside of a large circle. Enough experiments were made later to indicate a decided underestimation of the size of a dime without conscious reference to other coins. Nevertheless it is doubtless true that the coin series, or a part of it, is responsible for this great constant error. It is also probable that this tendency has been exaggerated in the present experiments by means of the attention given to the large circles before attempting to draw the dime. My supplementary experiments were not numerous enough to warrant a quantitative comparison.

A further *a priori* consideration may have contributed to the magnitude of the constant error, namely, the fact that a dime, though smaller than a nickel, has a greater value. Doubtless such an apparent contradiction is likely to be over influential, and as the value is clear the difference is transferred to the size. It is a double application of the principle of relativity. That is, as compared with the dollar in size the dime would be underestimated; as compared with the nickel in value and size it would also appear smaller than it really is (just as a small great man seems smaller than a small unknown man). The same processes would also tend to make the nickel larger than it would otherwise be, and I am not sure but this is the case.

In other respects Table IV shows the same peculiarities as the tables already presented. The average variation is of course smaller and is also more constant within each of the various groups. For the first time it becomes less than the constant error.

V.

The Nickel.

In trying to draw a circle the size of a nickel the children of the lower grades make nearly as large constant errors as when reproducing the size of a dime. The university stu-

dents, however, are much more accurate in this problem than they were in that of the smaller circle. In other respects Table V shows the same tendencies and characteristics as the preceding tables.

TABLE V.
Nickel = 21 mm.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	46	16.7	2.3	60	17.2	2.7
10	63	17.3	2.3	63	17.2	2.7
11	35	17.5	2.2	53	17.2	2.4
12	33	16.8	2.0	28	17.5	2.5
13	19	16.8	2.2	16	16.8	2.7
Average,		17.0	2.2		17.2	2.6

EIGHTH GRADE.

13	24	18.1	2.2	41	18.4	1.9
14	31	18.1	2.1	40	17.5	2.2
15	29	17.6	1.9	47	18.5	2.0
16	21	18.4	1.8	42	17.5	1.9
Average,		18.1	2.0		18.0	2.0

YEAR. PSYCHOLOGY CLASS.

1893	22	18.2	2.3	22	19.1	1.9
1894	30	19.9	2.7	42	20.0	2.2
1895	43	18.4	2.6	37	18.7	1.8
1896	53	18.8	2.0	33	18.9	1.7
1897	64	19.3	2.4	48	18.9	1.8
Average,		18.9	2.4		19.1	1.9

These five tables of judgments on the size of common coins may be studied together. They show that the less advanced children make all figures smaller than those made by the more advanced persons. Within any given class age does not seem to produce as great effect as does the degree of advancement in knowledge. That is, the children of nine years in the fourth grade do not, as a rule, make circles much different from those made by children thirteen years of age in the same grade. On the other hand thirteen-year old chil-

dren of the eighth grade usually differ considerably from fourth grade children of the same age. In all cases except that of the dime as drawn by university students, the girls make larger circles than the boys. The variation of the girls is in most cases greater than that of the boys. There is a slight tendency in both sexes to overestimate the size of the larger circles, and, proportionally, a much greater tendency to underestimate the size of the small circles.

In the average variation we observe much difference between elementary and advanced students except in the results for the two smaller circles. In the estimates of the dime and nickel, scholastic knowledge seems to contribute little toward a diminution of the differences between individuals. This is especially true in regard to the nickel.

VI.

Squaring the Circles.

After finishing their circles the pupils were asked to observe them in a careful manner, and to draw a square equal in area to the sum of the areas of all the circles. It is evident that this is a different kind of problem from those they had been dealing with. No memory image is necessary for the performance of the task now under consideration. No geometrical calculation would have assisted their judgment, for they had no accurate measurements, and the time at their disposal would not admit of even a hurried estimate based on a guess at dimensions and a calculation of areas. I believe, therefore, that the judgments were, for the most part, just as I desired them to be, off-hand estimates of the areas of the several circles in terms of a square.

The nearest possible approach to a systematic calculation would be in the rapid determination of the area of each circle in square inches and the summation of these results. The representation of a given number of square inches in the form of a square would then be a simple matter. It is not probable, however, that half even of the most advanced students made use of any similar methods, while only exceptional cases in the lower grades would have found any help from indirect methods. It is safe to say that in most cases the processes were unconscious, and that the comparison seemed to be immediate between the circles and their equivalent square. The square is therefore subject to two sources of error, inasmuch as the circles may have been wrongly drawn, and the translation and summation of the circles into a square may have been wrongly done.

TABLE VI.
Square, 54.2 mm. on a side.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	45	80.1	23.5	60	82.4	20.9
10	63	76.7	14.7	63	85.1	24.5
11	34	77.6	21.4	53	81.8	19.4
12	33	85.6	21.2	28	83.1	21.4
13	18	83.9	25.4	16	84.0	21.0
Average, Should be		80.8	21.3		83.3	21.4
		51.0			51.8	

EIGHTH GRADE.

13	25	69.2	13.4	41	69.9	15.3
14	31	64.4	8.9	40	69.3	14.5
15	29	63.0	9.5	47	66.4	12.7
16	21	60.8	12.0	42	79.3	17.0
Average, Should be		64.4	11.0		71.2	
		52.6			53.6	14.9

YEAR. PSYCHOLOGY CLASS.

1893	22	60.0	7.4	22	60.6	8.0
1894	30	63.7	10.2	42	70.2	11.9
1895	43	57.8	7.5	37	63.7	8.0
1896	53	58.8	8.1	33	64.1	9.1
1897	64	59.8	9.8	48	63.4	9.9
Average, Should be		60.0	8.6		64.4	9.4
		54.3			55.0	

The size of a square equivalent in area to the sum of the areas of the five coins is given at the head of the table. The size of a square equivalent to the average circles of each grade of pupils is given at the bottom of each division of the table. That is, the boys of the fourth grade should have made the square 51 mm. on a side instead of nearly 81 mm. If the circles had been made without constant error, each side of the square should have been about 54.2 mm.

The girls of the fourth grade make the largest squares (83.3 mm.). This is about two and one-half times the re-

quired area, and would be still thirty per cent. too large if we subtracted the entire average variation from the side of the average square. The boys of the fourth grade make a square but little smaller than that made by the girls.

Nearly half of the excess in the size of the square is lost in the work of the eighth grade pupils, though the difference between boys and girls is much greater than in the fourth grade. The average variation in this grade is but a little less than the constant error. There is much greater difference in the average variations of this entire table than of any other thus far considered. The problem is of course more complex, and hence individuals have greater latitude. It is rather surprising that the sub-groups within the same grade should differ so greatly from each other, especially in average variation.

The university students still further decrease the constant error until it is only about two-thirds as large as the average variation of the members of the class.

It will be noticed that the circles of the lower grades are smaller than they should be, and hence the square which would contain the actual circles before their eyes is smaller than that indicated at the top of the table. The boys of the fourth grade lose about 3 mm. on each side of the square in this manner, the girls about 2 mm. In the eighth grade the loss is smaller. The girls of this grade make the circles on the average almost exactly the right size. The undersize of the dime and nickel is made up by the overestimation of the dollar and half dollar. The university students have on the whole slightly overestimated the size of the coins, the men almost not at all, but the women have done so to an appreciable degree.

There is, after all, very little difference in the areas of the circles drawn by the several grades of students. The immense difference between the areas of the squares as drawn by fourth grade pupils and university students is due to overestimation of the circles by the lower grades—to the inability of the more immature children to square the circles. It will be thought that the children misunderstood the problem. It is true that some few may have believed, after all warning and explanation, that I desired a square which would *contain* the circles unbroken. I believe, however, that very few persons failed to grasp the problem of equivalent areas.

VII and VIII.

The Size of a Five-Dollar Bill.

Tables VII and VIII are most interesting. It was required to draw a rectangle equal in size and similar in form to a five-

dollar bill (or a one-dollar bill). This problem presented great difficulty, if we judge by results, and yet the subjects seemed to have much confidence in the accuracy of their work. The proportion in the form was well maintained throughout the papers, thus indicating clearly that the persons concerned knew what they were trying to do. We must also believe, in this case at least, that the larger size of the bill, as made by advanced students, is due chiefly to more accurate power of imaging.

The constant error is so unexpectedly large, and the difference between fourth grade pupils and university students is so great, that the factors which might account for the divergences in case of the circles will not be accepted here. The slight influence of age as compared with that of grade is seen in these two tables more clearly than I remember to have seen it elsewhere. But it may be said that this whole paper is a striking illustration of the same fact, and it is just about time for some evidence of this kind to be forthcoming, since there has been a tendency to affirm the opposite on the evidence furnished by several experimental researches. It is perhaps a fault of the psychological monograph to generalize beyond its province. It is clear that, as far as these tables show, age has little to do with accuracy of reproduction of space relations, while the degree of academic advancement has much to do with the matter. We must not conclude, however, that greater extremes of age, or other problems in space relations, would show the same kind of results. It is at least unwise to make any generalization on this point without more facts than are at present in our possession.

It seems almost incredible that over 400 children, who have had four years' training in our public schools, should, on the average, think of a dollar bill as barely half its actual size. Has instruction in drawing called away attention from magnitude in order to emphasize form? There would seem to be at least great neglect in the recognition of absolute dimensions, perhaps not unlike the well-known inability of most musicians to judge the absolute pitch of tones.

Reference to the original tables shows that only four fourth grade children out of 415 made the bill long enough, and only thirteen made it wide enough. In the eighth grade, out of 275 pupils, only six made the bill long enough, and only sixteen made it wide enough. Of 394 university students twenty-four made it long enough, and fifty-eight wide enough.

Considering the size of the constant error in Table VII, the variation among individuals is but little. In the fourth grade it amounts to less than one-third of the constant error, and decreases in the higher classes, though not nearly as fast as

TABLE VII.
Length of Bill = 186.5 mm.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	46	120.6	19.8	60	119.5	17.1
10	63	123.6	20.5	63	122.8	17.4
11	35	123.8	16.6	53	129.6	17.4
12	33	117.2	21.6	27	129.6	16.4
13	19	119.3	18.4	16	118.3	23.8
Average,		120.9	19.4		124.0	18.4

EIGHTH GRADE.

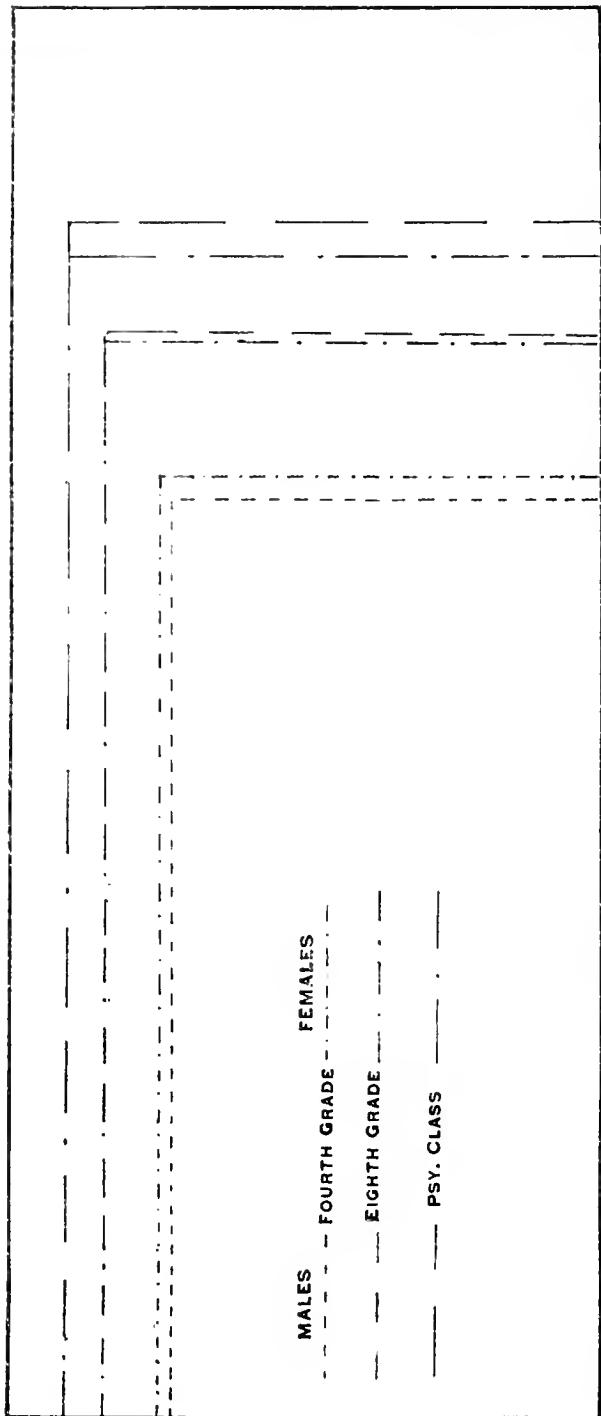
13	25	146.7	14.2	41	144.9	16.8
14	31	140.1	15.4	40	138.0	17.1
15	29	137.1	18.3	47	140.0	17.5
16	21	146.2	17.7	41	143.4	15.4
Average,		142.5	16.4		141.6	16.7

YEAR. PSYCHOLOGY CLASS.

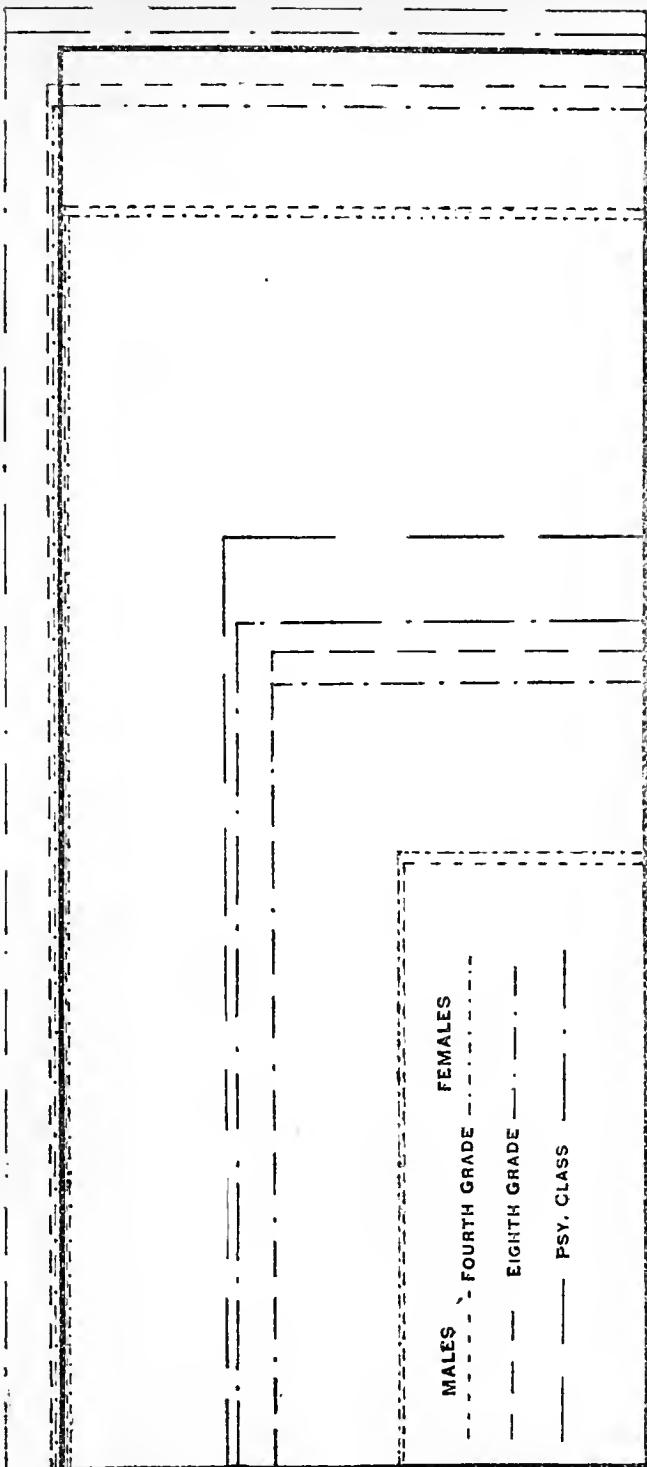
1893	22	153.1	14.2	22	154.6	16.4
1894	30	163.3	19.5	42	151.4	17.4
1895	43	158.4	12.9	37	147.6	16.2
1896	53	155.8	14.6	33	155.6	16.3
1897	64	156.4	15.4	48	156.2	18.5
Average,		157.4	15.3		153.1	17.0

the constant error decreases. For the university students the variation is about three-fourths as large as for the fourth grade pupils, and is about one-half as large as the constant error.

The width of the bill is judged somewhat more accurately, especially by the university students. The accompanying figures indicate the nature and extent of the constant errors in both length and width. The dimensions of the bill used in these figures and also at the head of Tables VII and VIII were obtained by the actual measurement of fourteen five-dollar bills, ten two-dollar bills and ten one-dollar bills. The



Size of five-dollar bill. Average.—Heavy line indicates actual size of bill. Broken lines show the averages of all judgments in the several divisions.



Size of five-dollar bill. Maximum and minimum judgments.—Heavy line indicates actual size of bill. Broken lines show average of extreme cases. Each dimension is the average of ten per cent. of all judgments in that particular division.

TABLE VIII.
Width of Bill = 78.5 mm.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	45	55.9	11.0	60	58.0	7.7
10	63	58.6	8.7	63	57.1	10.7
11	34	59.4	9.6	53	60.9	9.2
12	33	55.2	10.3	27	61.3	9.7
13	19	54.5	7.2	16	55.1	8.6
Average,		56.7	9.4		58.5	9.2

EIGHTH GRADE.

13	25	65.4	6.1	41	67.2	7.1
14	31	66.9	7.7	40	64.8	6.9
15	29	62.7	6.3	47	64.7	7.6
16	21	69.0	7.6	41	66.7	5.6
Average,		66.0	6.9		65.9	6.8

YEAR. PSYCHOLOGY CLASS.

1893	22	70.5	4.9	22	71.2	8.1
1894	30	73.4	9.5	42	72.8	7.1
1895	43	69.9	5.9	37	68.2	6.6
1896	53	69.0	5.6	33	69.1	5.2
1897	64	70.2	6.2	48	70.1	6.7
Average,		70.6	6.4		70.3	6.7

greatest variation in length of these bills was nine millimeters, and in width four millimeters. The bills were taken at random and the average dimension became the standard.

The explanation of so large constant errors will occur to every one. We seldom see bills spread out at full size. They are generally folded, and we observe one end as a mark of their denomination. If they were made of clay or steel we should probably exaggerate their size. Of course we are not accustomed to think of value in relation to size of bills, since all denominations are practically the same in size. The fact that the error is slightly less for the width than for the length adds to the force of this explanation. We are more accustomed

to see the width of a bill, and generally the width is seen in a way to enlarge our estimate of its size, inasmuch as it becomes the *length* of the folded bill.

I asked a few experts in banks to draw this figure and they made exceedingly small errors. One drew a rectangle 183x72 mm. When asked how he estimated the size for his drawing, he replied that he imagined it passing through his fingers. Hence with him the judgment was rather tactal than visual. Another bank teller drew the length exactly right, but overestimated the width by ten millimeters.

TABLE IX.
Three-Inch Circle = 76.2 mm.

FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation
9	44	72.3	9.8	60	70.5	14.3
10	63	79.0	12.6	63	76.5	11.6
11	34	78.2	8.5	53	75.2	10.3
12	33	79.5	10.7	28	70.4	11.8
13	19	76.8	13.9	16	70.9	15.3
Average,		77.2	11.1		72.7	12.7

EIGHTH GRADE.

13	25	78.0	8.5	41	74.6	10.5
14	31	81.8	6.8	40	75.8	8.2
15	29	74.9	8.1	47	74.7	8.9
16	21	77.0	9.0	42	79.1	9.9
Average,		77.9	8.1		76.1	9.4

YEAR. PSYCHOLOGY CLASS.

1893	22	76.0	9.0	22	74.5	7.1
1894	30	85.0	10.7	42	77.4	8.8
1895	43	77.0	8.5	37	79.3	6.5
1896	53	80.7	9.6	33	78.2	7.7
1897	64	78.6	9.2	48	77.7	9.4
Average,		79.5	9.4		77.4	7.9

IX.

A Circle Three Inches in Diameter.

Draw a circle three inches in diameter (or three inches across), was the problem whose results are given in Table IX. The subjects were not prohibited from marking off a line as diameter, and were allowed to make corrections as usual. Perhaps nearly half used the method of a line as a guide, though I always suggested that they make the circle with freehand movement and attend to size more than to roundness.

The boys of all grades made the circles too large, but the error of the lowest grade is very small. The girls of the lowest grade made the circles too small. The higher grades make larger circles, and again the eighth grade children are more nearly right than the university students. As far as this problem alone is concerned, it would have been more satisfactory to have asked for a line three inches long. I wished, however, to use the circle for another purpose involving area, and besides, this whole investigation is on estimation of surface. While Table IX does not add much to the results of the preceding tables, it corroborates our conclusions drawn from those tables.

The variation of the girls in the fourth grade is much greater than that of the boys. In the eighth grade it is still somewhat greater, but in the university classes the girls now differ from each other less than the boys do. The subordinate groups in each division differ from each other more than in any other table except that of the square. Since this difference is not influenced by age, its cause is probably to be found in the greater difficulty of the problem.

X.

A Square One Inch on a Side.

A square inch is 25.4 millimeters on a side. There is a slight tendency in all classes, except university women, to make it too large. The average of the university women is almost exactly the right size. The variation is not large, but the more advanced students differ from each other nearly as much as the elementary pupils of the fourth grade.

This problem is unlike that of the reproduction of coins. It depends upon the constructive imagination rather than upon a concrete memory image. We are accustomed to see coins as surfaces, while the square inch is, perhaps, never seen by the average person with full recognition of its name

TABLE X.
Square Inch = 25.4 mm.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	43	25.5	3.0	58	27.8	4.9
10	63	26.0	3.5	63	27.8	4.7
11	32	26.8	2.8	53	27.6	4.0
12	32	27.6	3.9	27	29.6	4.8
13	18	25.4	5.5	16	29.4	4.0
Average,		26.2	3.7		28.4	4.5

EIGHTH GRADE.

13	25	25.6	2.4	41	27.4	3.9
14	31	26.6	2.9	40	26.6	2.7
15	29	24.4	2.4	47	27.3	3.1
16	21	26.4	3.5	42	27.4	3.6
Average,		25.8	2.8		27.2	3.3

YEAR. PSYCHOLOGY CLASS.

1893	22	25.6	3.2	22	24.6	2.5
1894	30	27.5	4.2	42	25.8	2.8
1895	43	25.8	3.3	37	26.0	2.9
1896	53	26.6	3.9	33	25.3	3.4
1897	64	25.6	3.7	48	25.1	3.6
Average,		26.2	3.7		25.4	3.0

and with confidence in the accuracy of its dimensions. We have no article in common use which represents to us the surface of a square inch. Our visual image of this figure, then, is constructed from our memory image of a linear inch. The table shows that there is a slight constant tendency to overestimate the area of this square, and that the tendency is more decided with the lower grades, especially on the part of the girls. In all judgments of this kind, even more than in such as are represented in the first five tables, the direction of the error is a function of the mental character, and usually it may be predicted with considerable accuracy.

XI.

An Equilateral Triangle Equal in Area to the Three-Inch Circle and the One-Inch Square.

This problem was not given to the children of the fourth grade, because it was not believed they would be able to understand exactly what was wanted, without more suggestion than it was thought best to give. The eighth grade and university classes tried to solve the problem, but with rather unsatisfactory results, as the table shows. Nothing particularly important was expected from this exercise. It was suggested

TABLE XI.

Equilateral Triangle = 110 mm. on a side.

EIGHTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
13	25	110.0	15.9	40	108.2	20.4
14	31	113.6	14.6	40	107.7	16.7
15	29	107.2	15.7	47	102.8	18.6
16	21	102.4	15.1	42	102.7	13.6
Average,		108.3	15.3		105.3	17.3

YEAR.	PSYCHOLOGY CLASS.					
	1893	1894	1895	1896		
1893	22	108.4	14.1	22	103.3	9.2
1894	29	118.0	17.3	40	104.2	13.4
1895	43	110.5	17.1	37	109.8	14.3
1896	53	112.4	16.0	33	105.7	15.1
1897	64	109.2	18.4	48	107.2	16.4
Average,		111.7	16.6		106.0	13.7

by the previous problem of squaring the circles, and while the results are not as surprising as those in Table VI, they are worth noting. The constant error is insignificant, though the variation is larger than in most other tables. There is considerable uniformity in the results of both classes and of the groups in each class. It is evidently a much simpler matter to include the large circle and the small square in an equilateral triangle, than to reduce five diverse circles to the form of a square.

The average length of the three sides was taken as the

standard in order to save computation. Only in a few cases would the area differ greatly from an equilateral triangle with sides equal to the average of those drawn. The figures at the head of the table indicate the size of an equilateral triangle, which is equivalent to a three-inch circle and an inch square. The small constant errors made in drawing the circle and square must therefore be considered in calculating the constant error for the triangle.

The Dimensions of the Paper.

Tables XII, XIII and XIV contain the estimates on the length and width of the paper, and on the length of the diagonal. The estimates are, of course, in inches.

TABLE XII.
Length of Paper = 14 inches.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	45	13.9	1.8	57	13.4	1.4
10	63	14.9	2.3	63	13.8	1.9
11	35	14.5	2.0	53	13.8	1.9
12	33	13.9	1.4	28	12.9	.9
13	17	14.5	1.6	16	12.7	1.6
Average,		14.3	1.8		13.3	1.5

EIGHTH GRADE.

13	25	14.1	1.0	41	14.2	1.2
14	31	13.7	1.5	40	14.1	1.4
15	28	14.5	1.3	46	13.7	1.2
16	21	13.7	1.3	42	13.6	1.4
Average,		14.0	1.3		13.9	1.3

PSYCHOLOGY CLASS.

YEAR.						
1893	22	15.2	1.3	22	15.1	1.3
1894	29	14.0	1.5	42	14.4	1.8
1895	43	14.7	1.2	37	14.3	1.6
1896	48	14.5	1.6	29	14.4	1.4
1897	64	13.9	.9	48	14.1	1.8
Average,		14.5	1.3		14.5	1.6

TABLE XIII.
Width of Paper = 9 inches.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	44	8.7	1.5	55	8.6	1.2
10	61	9.2	1.6	61	8.9	1.6
11	34	8.7	1.3	53	8.7	1.4
12	33	9.5	1.5	27	8.2	1.0
13	17	9.2	1.3	16	8.2	1.5
Average,		9.1	1.4		8.5	1.3

EIGHTH GRADE.

13	25	8.8	.9	41	9.0	.8
14	31	8.5	1.0	40	9.0	1.3
15	28	9.0	.8	46	8.8	1.0
16	21	8.5	1.1	42	8.7	1.0
Average,		8.7	1.0		8.9	1.0

YEAR. PSYCHOLOGY CLASS.

1893	22	9.8	.9	22	9.6	1.0
1894	29	9.1	1.4	42	9.4	1.2
1895	43	9.4	1.2	37	9.2	1.2
1896	48	9.5	1.2	29	9.6	1.2
1897	64	9.1	1.1	48	9.3	1.2
Average,		9.4	1.2		9.4	1.2

A slight tendency to overestimate the length is seen in all divisions except that of the fourth grade girls, who underestimate this dimension about three-quarters of an inch. The variation is the lowest we have yet found, being on the average somewhat less than ten per cent. of the estimated size of the paper. Most children in the public schools have a fair conception of the foot as a unit of length. The paper being appreciably longer than a foot would be comparatively easy to estimate. There are, however, individuals who have no conception of any unit of length, as the table of extreme cases shows (Table XV).

The width of the paper was not as accurately judged as

the length, even by the university students. I infer that the principal cause is the greater difference, both relative and absolute, between the standard—one foot—and the dimensions to be estimated. The girls of the lower class underestimate the width about as much as the students of the psychology class overestimate it.

TABLE XIV.
Diagonal of Paper = 16.6 inches.
FOURTH GRADE.

AGE.	No. of Persons.	MALES.		No. of Persons.	FEMALES.	
		Average.	Av. Variation.		Average.	Av. Variation.
9	41	17.6	2.9	52	17.0	2.5
10	60	18.7	3.2	60	17.2	2.7
11	30	17.5	3.1	49	17.3	3.3
12	31	17.7	2.7	27	16.3	1.8
13	15	18.8	3.4	16	16.4	3.5
Average,		18.1	3.1		16.8	2.8

EIGHTH GRADE.						
13	25	17.4	1.6	38	18.0	1.8
14	29	16.9	1.6	36	17.9	2.0
15	28	18.0	2.1	46	17.7	2.2
16	21	17.1	1.6	38	17.3	2.2
Average,		17.4	1.7		17.7	2.1

PSYCHOLOGY CLASS.						
YEAR.						
1893	22	19.1	2.9	22	18.4	2.1
1894	29	17.4	2.5	40	18.2	2.1
1895	43	18.3	1.9	37	17.4	2.1
1896	48	17.5	1.8	28	17.9	2.1
1897	64	17.1	1.3	48	17.1	2.2
Average,		17.9	2.1		17.8	2.1

The diagonal of the paper was still more difficult to judge, partly because of its greater length and the absence of any distinct line like the edge of the paper, and partly because it differed more from the most common unit of linear measure, the foot. The actual length of the diagonal is 16.6 inches.

It is seen from the table that neither age nor academic rank aids one much in this exercise. The length of the diagonal is overestimated by nearly every division. The girls of the fourth grade, having the lowest figures here, as in the two preceding tables, have overestimated least, and hence seem to be most accurate in judgment of this dimension.

The variation naturally rises with the increased difficulty of the problem. It also differs more than usual in the various divisions of the same class of observers; as, for example, in the groups of twelve and thirteen year old girls of the fourth grade, where it varies from 1.81 to 3.47, and in the men of the university classes from 1.26 to 2.90. On the other hand the women of the university classes have the most uniform variation of any table.

XV.

Maximum and Minimum Judgments.

Some notion of the range of judgment is a necessary supplement to the foregoing exhibit. It has seemed to me best to present this in a condensed table containing a certain proportion of the judgments of each class. I have, therefore, given in Table XV the average of ten per cent. of all judgments in each class selected from the highest figures, and also the average of ten per cent. taken from the lowest figures for each problem. Table XV then gives for every hundred judgments the average of the ten highest and the average of the ten lowest. For comparison with my other tables this seems to be a better method than to give the judgment which is exceeded by ten per cent. and that which is not reached by ten per cent. of the subjects.

The table explains itself. In the fourth grade the average of the highest judgments is almost exactly twice the average of the lowest judgments. With age and learning the difference between extremes becomes less; but even with university students the average of the maximum is about one and two-thirds times the average of the minimum judgments.

The first problem of special interest in this table is the maximum size of the dime. The average of the tenth yielding the largest judgments barely exceeds the real size of the dime, while the average of the smallest judgments is almost incredibly small. Many of the children drew a dime smaller than the diameter of a common lead pencil, and only about as many made it as large as a nickel. Not one person in ten made it large enough, while almost one in ten made it only half big enough.

The most interesting problem is the five-dollar bill. The

TABLE XV.
Maximum and Minimum Judgments.

Each number is the average of ten per cent. of the persons in that particular division.

	Size. Mm.	SEX.	4TH GRADE.		8TH GRADE.		PSY. CLASS.	
			M	F	M	F	M	F
Dollar,	37.8	M	49.5	26.9	46.1	31.1	48.8	30.7
		F	52.1	24.1	48.8	31.4	49.9	31.6
Half Dollar,	30.6	M	40.3	20.7	38.0	24.2	40.0	24.5
		F	42.7	17.9	39.6	24.9	40.6	25.3
Quarter Dollar,	24	M	31.0	15.9	29.0	17.9	31.8	18.6
		F	32.8	14.5	30.8	19.2	31.2	19.5
Dime,	19	M	20.0	9.9	18.7	11.5	20.3	11.0
		F	19.7	9.7	19.1	11.6	19.5	11.8
Nickel,	21	M	22.7	12.1	21.8	13.9	24.4	13.8
		F	22.8	10.9	22.4	13.4	23.7	15.4
Square,	54.2	M	137.7	45.0	93.0	43.4	82.7	42.6
		F	133.1	43.2	114.5	42.6	94.7	45.0
Bill, long,	186.5	M	167.3	80.2	181.4	107.9	191.8	122.9
		F	165.7	81.5	178.7	103.9	188.4	111.9
Bill, wide,	78.5	M	78.1	37.3	80.1	49.5	85.5	56.0
		F	77.3	38.0	79.5	49.6	85.2	54.3
Circle, 3 in.,	76.2	M	104.1	51.3	94.4	59.7	105.1	60.5
		F	102.7	44.4	99.0	54.3	96.8	59.6
Square Inch,	25.4	M	36.7	18.2	32.7	19.8	34.9	18.6
		F	41.3	20.5	35.4	20.9	32.4	18.5
Triangle,	110	M			149.0	77.1	152.1	78.9
		F			150.2	67.8	139.2	76.8
Paper, long,	14	M	20.7	11.3	17.3	10.9	18.0	11.6
		F	18.1	10.0	17.0	11.0	18.6	11.2
Paper, wide,	9	M	12.7	5.9	11.0	6.3	11.7	7.2
		F	12.1	5.9	11.8	6.8	12.3	7.8
Paper, diag.,	16.6	M	26.4	12.8	22.4	13.8	23.0	14.3
		F	23.7	11.4	23.4	13.7	23.3	13.8

accompanying figures illustrate the extremes and also the average judgments. In the fourth and also in the eighth

grade, the maximum judgment of length fails to reach the actual length, and even in the university classes exceeds it only a few millimeters. The minimum of the fourth grade gives us a bill scarcely longer than the width of a real bill and a width about one-fifth as great as the real is long. Hence, the average minimum bill is about one-fifth the actual bill. Remembering that all maxima and minima are each the average of ten per cent. of the judgments of the given division, the monstrosity of the results is apparent. Those who make the bill large enough are veritable freaks; while those who make it only half large enough are the normal persons.

SUMMARY.

From observations on nearly eleven hundred persons, the following points, among others, may fairly be said to be established:

- I. Our notions of the size of familiar objects differ widely.
- II. Young children underestimate the size of coins and bills.
- III. Mature persons of intelligence overestimate the size of the silver dollar, half dollar and quarter dollar.
- IV. All classes of persons underestimate the size of the dime, nickel and bill.
- V. Girls make larger coins than boys and also larger equivalent squares. In other problems of this investigation the boys make the larger figures.
- VI. The judgments of the eighth grade children are more uniform than those of either the fourth grade children or university students, and are more nearly like the latter than the former.
- VII. The more advanced classes produce *larger* coins and bills than the elementary classes; but within the same class age causes no appreciable effect.
- VIII. It is probable that the reproduction of such objects as are here studied, is a function of the *personality* apart from knowledge or mental acumen.
- IX. The enormous errors in reproducing the bill and dime, suggest that the teaching of drawing in public schools may profitably concern itself more with size.
- X. To young children a memory image is smaller than its object, while in the minds of adults it may exceed the object in size.

A CONTRIBUTION TO THE STUDY OF ILLUSIONS,¹

WITH SPECIAL REFERENCE TO

- (a) THE EFFECT OF SIZE UPON ESTIMATIONS OF WEIGHT,
- (b) THE EFFECT OF CONTOUR UPON ESTIMATIONS OF AREA.

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This study grew out of a general study instituted by Professor Jastrow, in 1892, for the purpose of studying the possibility of suggestibility in normal individuals. It was first directed toward a study of the creation of actual illusions of certain types. For example, an illuminated surface was made to appear to grow brighter, a space made to appear to grow larger, a sound to grow louder, or a heated tube to grow hotter, without actually becoming so.

In this connection it was important to determine how great was the actual illusion and how suggestible each of the senses might be. Some results from this line of research may be found embodied in a thesis on "A Study of Sensibility with Special Reference to Suggestion," prepared by Messrs. G. M. McGregor and B. R. Shurly, and deposited in the library of the University of Wisconsin.

As a further contribution, it was deemed important to make a study of certain relations of sense perceptions to each other, which would lead to a quantitative determination of the influence one sense may have in acting as a suggestive factor over another.

This study grew out of the former study, and was outlined when the announcement of Dr. Gilbert's article was first made and when a description of Seashore's "Suggestion Blocks" was given in Willeyoung's catalogue of supplies. Hence, to make the results conformable, the same size of blocks was determined upon for this study. The methods of experimentation, however, were unknown at the time and

¹ A minor thesis submitted as a partial requirement for the degree of Master of Science in Pedagogy, University of Wisconsin, 1896.

consequently the methods are only partially coincident. Since the experiments were begun (just before commencing the tabulation of results), a very thorough and exhaustive study was published by Dr. Seashore under the title "Measurements of Illusions and Hallucinations of Normal Life" (*Studies from Yale Psychological Laboratory*, Vol. III, 1895). Another treatment of the same subject from a little different standpoint in the previously mentioned article by Dr. Gilbert preceded Dr. Seashore's article. (See *Yale Studies*, Vol. II, 1894, article, "Researches on the Mental and Physical Development of School Children.") The latter's subjects were children, while Dr. Seashore's and those herein considered were adults, mainly from college classes. Hence, the following contribution will be for the first part mainly corroborative of what has already received fairly adequate treatment.¹ A few variations in method and in results will be noted. The second part deals with a problem heretofore unworked.

PART I.

Apparatus.

Two sets of cylindrical discs, 31 mm. long, were made of wood which was painted black so as to represent a uniform surface. The first set (*U*) consisted of 17 discs 31 mm. long, and having a uniform diameter of 60 mm., but of weights varying by 5 g. each in a constant arithmetical progression. The lightest was 20 g. and the heaviest 85 g. in weight. The second set (*V*) consisted of 13 discs so made as to have a constant weight of 55 g. each, but varying in diameter by a regular increment of 0.1. The set contained the following sizes :

29.28 mm.	47.15 mm.	69.04 mm.
32.21 "	51.87 "	75.94 "
35.43 "	57.06 "	83.54 "
38.97 "	62.76 "	91.89 "
42.87 "		

¹ In this connection mention should be made of Dr. F. B. Dresslar's contribution in the "Studies in the Psychology of Touch," this JOURNAL, VI, June, 1894. One part of the study deals with the illusions of weight produced by size. His weights were of constant diameter, but of varying heights.

These are essentially the same as Seashore's "B." Two racks, resembling the keyboard of a piano, were made containing a set of 18 levers or keys about 200 mm. in length, placed side by side and balanced in the middle upon a brass rod, which served as a fulcrum for all. Glass bearings were provided to reduce the friction to the minimum. On one end of each lever a mortise was made to hold the respective discs. A point was found on the opposite end of each lever, where a pressure just equal to the weight on the other would just balance the weight. On this spot a rubber button was fastened to indicate the point. Each of the racks was provided with a movable screen so that in the first experiment in each series the observers had no knowledge of the size, shape, or other qualities of the discs.

EXP. I., SERIES I. SET "U."

Lever pressure method. Discs screened from view.

With the discs (*U*) screened from view the observer was asked to seat himself by the side of the rack, and by pressing upon the buttons on the keys, to select a weight just equal to the one on a certain key which contained the standards. The subjects were informed that the discs formed a weight series, and were also told the direction of the series.

For standards I used five discs, three of which were 60 mm. in diameter and weighed 35 g., 50 g. and 65 g. respectively; the other two weighed 55 g. each, but one ("1") was 90 mm., and the other ("s") 30 mm. in diameter. The only instructions given to the observers were that by first testing the standard, they should select, with the same hand and same finger, a weight just equal to the standard. Each one was at liberty to refer alternately to the standard as many times as he chose. However, if too many trials were made the subject was cautioned against fatigue. Usually the judgments were the best if only two or three repetitions were made with the standard and the one thought to be about right. If more trials were made, the subject frequently abandoned the first one and selected one not so nearly correct. In such cases a second trial was given later on.

The standards were presented in an irregular order, and were removed each time, so that the observers did not know throughout the whole series that they had tested the same one more than once. Each of the twenty-five observers was given two trials with each standard.

The first experiment was made with the discs screened from view, so as to be assured that no illusion could possibly arise

in that way, and to show that the selections were not mere chance guesses. Incidentally, it was a test of the accuracy of selection of equal weights by the lever pressure method. The results of the averages of 50 trials with each standard are as follows :

TABLE I.
Uniform series. Lever pressure. Screen.

Standards.		Average weight of disc selected.	Average variation.	Diameter of Series.
Diameter.	Weight.			
60 mm.	35 g.	29.02 g.	6.95 g.	60 mm.
60 "	50 "	38.05 "	12.6 "	60 "
60 "	65 "	52.17 "	13.48 "	60 "
"1" 90 "	55 "	47.39 "	10.5 "	60 "
"s" 30 "	55 "	47.60 "	9.8 "	60 "

(“1” indicates the disc 90 mm. in diameter and “s” the one 30 mm. in diameter, throughout the discussion.)

From the table we see that all the average selections are brought within a range of 10% of each other. The table shows in the first three lines that in comparing by the muscle pressure method, when selecting from the series in exactly the same manner as the standard is tested, there is a decided tendency to choose too small a weight. This is true of all three weights and the decisions are uniformly in one direction. Of the 150 judgments there were only seven in the opposite direction, *i. e.*, only seven were selections greater than the standards. These seven answers were confined to five persons; hence, we have over 80% of the subjects and 95% of the answers in partial concord concerning this tendency.

The three discs were underestimated by about 6 g., 12 g., and 13 g. respectively. This result does not at all agree with Dr. Seashore's. He finds when the weights were concealed from view there was no tendency to underestimation or exaggeration, and further that the difference between the standard and the ones selected never exceeds 2 grams on the average.¹

We find further that the large disc “1” and the small one

¹ See p. 10, Table IV, Seashore's article. His method, however, was different.

"s" are underestimated, although not seen, and in about the same proportion as the other three. It is noticeable that "1" and "s" have selections made for them which are equal to each other, and also that the average variation for these two are practically the same. This shows that chance has not determined the answers, and that the same tendencies are operative, whatever the size or shape of the objects, when not seen. The cause of the tendency to underestimation is at present unexplainable.

EXP. 2, SERIES I.

Lever pressure—Set "U." Discs in sight.

With the screen removed from the rack the observer was requested to select in the same manner as before discs that were equal in weight to each of the standards. Thus, in this experiment, the muscle pressure method was used, but was aided by sight. Each of the five standards was given twice to the 25 observers, making 50 experiments with each standard. The object of this test was to determine quantitatively how great an influence, if any, sight has upon judgments relating to weight. In other words, to determine whether sight acts as a suggestive factor in producing illusions of weight. In this experiment the following tabulated results were obtained :

TABLE II.
Uniform Series—Lever pressure—In sight.

Standards.		Average weight of disc selected.	Average varia- tion.	Diameter of series.
Diameter.	Weight.			
60 mm.	35 g.	28.3 g.	8.0 g.	60 mm.
60 "	50 "	38.5 "	12.4 "	60 "
60 "	65 "	50.7 "	14.3 "	60 "
90 "	55 "	43.1 "	12.4 "	60 "
30 "	55 "	51.8 "	7.3 "	60 "

It will be noted that for the first three used as standards the results are almost identical with those of the first three in Table I. This agreement is as we should expect, since these three standards are of the same size, shape, color, and in every visible way exactly like those selected from. We find

again the same strong tendency to underestimation that was observable in Table I. There is a deviation, however, in case of "l" and "s." For "l" the selection in the previous table was 4.2 g. *larger*, and for "s" the selection was 4.2 g. *smaller* than in the second table. These results show that as soon as sight of the objects comes in to assist in selecting equal weights by the lever pressure method, the tendency to underestimation is reduced, especially in case standards, of unusual density (great or small) are used. However, for the first three there is no appreciable deviation either way.

With the 35 gram standard, four made overestimations; with the 50 g. standard, two made overestimations; with the 65 g. standard there were none; with "l," two; and with "s," eleven who made overestimations. This shows that size acts somewhat as a factor in determining weight, and that illusions tend to be produced by unusually great or small density. The amount of suggestion in grams varies inversely as the increased or diminished diameter of the standard discs. That is, "l" is 30 mm. *greater* in diameter than the series, and the *additional* 30 mm. diameter produces a *decrement* of 4.2 g. in weight; while "s," which is 30 mm. *smaller* than the standards, produces an *increment* of 4.2 g. in weight. From this experiment we conclude from all five lines that: 1. Objects when compared by the lever pressure method are underestimated, even with the additional aid of sight. 2. A variation in density of the objects tends to increase or diminish this tendency. 3. Objects of similarly appearing material, but of different density, appear to differ in weight when compared. 4. The larger induce a decrement of estimated weight; the smaller induce an increment of estimated weight. 5. The intensity of this illusion varies in a direct sense as the amount of difference in diameter between the discs compared.¹ 6. This verifies Weber's law that proportional increments are perceived as equal increments. (Provided we mean diameters.) In the above experiments the diameters were to each other as 3 : 6 : 9, and the increments of weight were perceived as equal.

EXP. 3, SERIES I.

Set "U." Discs in sight. Lifted between thumb and finger.

The next step was to compare the weights by active lifting or "hefting." The most accurate sense of weight is obtained in this way, because we have the additional aid of the tactile

¹ See Seashore's article, p. 5. He says "directly as the diff. of size." He probably means *diam.*

sense. Of greater importance, also, are the joint sensations which come into play and give added data for judgment. Through long practice in this manner of estimating weight we have become able to make finer discriminations of weight than when any of these factors are omitted.

In this experiment a piece of wood the length of the rack and gouged out, served as a trough, in which the blocks were placed so that the standard discs might be moved into position whereby the same angle of hand and arm could be maintained. The observer was required to grasp the two ends of the discs between the thumb and either fore-finger or middle finger. Therefore, in all cases, the same span, grip and tactile sensations were preserved. Had the observer been allowed to grasp the discs around the circumference, an additional aid in determining volume would have been gained. But the aim was to have the perception of size depend entirely upon sight, as in experiment 2. The results obtained are given in the subjoined table.

TABLE III.
Set "U"—*In sight—Active lifting.*

Standards.		Average weight of disc selected.	Average varia- tion.	Diameter of series "U."
Diameter.	Weight.			
60 mm.	35 g.	35.5 g.	2.1 g.	60 mm.
60 "	50 "	49.1 "	4.5 "	60 "
60 "	65 "	62.8 "	3.1 "	60 "
90 "	55 "	40.3 "	(-)14.7 "	60 "
30 "	55 "	69.5 "	(+)14.5 "	60 "

In this set of experiments the results of the comparison of the first three standards show no illusion, as they ought not, the size being the same as the discs compared. The only difference between these results and those corresponding in Tables I and II are that in Table III the average weights of the discs selected are much nearer to the standards. This is due to the additional factor mentioned above which is promotive of accuracy. In the first case we find that the average of the estimates is a trifle greater than the standard. The second and third are very much nearer the standards than before, but still underestimated. The average errors are in all three

cases very small, which shows the constant direction of the answers. The illusion produced by the discrepancy between size and expected weight comes out very strongly in case of "l" and "s." Between "l" and the one selected there is a difference of -14.2 g., while between the smaller one, "s," and the one selected there is a difference of +14.5 g. The average errors, of course, coincide with the actual differences, since all *underestimated* in selecting one equal to "l" and *overestimated* in selecting one to equal "s." The deviations from "l" and "s" are numerically equal, but opposite in sign. As in experiment 2, the standards vary from the normal, or from the series, by 30 mm. each in diameter and in opposite directions from the series. We may conclude from this that the same law as was stated in discussing experiment 2 holds true, viz.: that the intensity of the illusion varies in a direct sense as the amount of difference in diameter between the discs compared. In fact, all the laws governing the operations in experiment 2 hold true in this one. The only differences are that by the last method actual weights are more accurately perceived when size is not a modifying factor; and when an illusion is produced by differences in density, the illusion is much stronger by lifting than by the lever pressure method.

SERIES II.

In the second series of experiments with the same five standards, three sets of experiments were performed. But in this series the set "V" (variable in size) was used to select from. So that in this series we had three standards of equal diameter and two of varying diameter, also a varying set, from which to select. This increase of variable factors rendered the problem a more complex one than the preceding. Bearing in mind that all were 55 g. in weight, and varying in diameter by a regular increment of 0.1, we pass to—

EXP. 1, SERIES II.

Set "V"—Lever pressure—Screen.

With the discs screened from view of the observers, they were asked to select a disc equal in weight to the standards presented. This time they were uninformed concerning any of the properties of the series. In the same manner by pressure upon the keys, and in the same number of experiments as in each one of the preceding series, the following results were obtained:

TABLE IV.

Set "V"—Lever pressure—Screened.

Size of series variable by increment of one-tenth from 29.28 mm. to 91.89 mm.
Weight 55 g.

Standards.		Average diameter of disc selected.	Difference between average and standard.
Diameter.	Weight.		
60 mm.	35 g.	49.2 mm.	-10.8 mm.
60 "	50 "	53.2 "	-6.8 "
60 "	65 "	39.1 "	-20.9 "
90 "	55 "	48.4 "	-11.6 "
30 "	55 "	45.4 "	+15.4 "

No regularity can be detected in the results, which indicates that they are purely chance answers. Some thought that the discs were arranged in a series running one way, and about as many thought the series ran in an opposite direction. Others thought they were arranged in an irregular order. Twelve of the observers detected that the standard 35 g. was lighter than any in the series. Few expressed any certainty, a large number doubt concerning their answers to this one. Only one asserted that the entire series was lighter than the standard 65 g., yet a number said they did not feel very sure concerning their selection. That a larger one should be selected to correspond to "l" than for "s" is purely accidental. In many cases I asked the subject to compare "l" and "s," he not seeing them, and invariably they were said to be the same. At the conclusion of all the experiments the two were compared by lifting and in sight. In this case they always declared that "s" was twice as heavy as "l," some said three times as heavy, and could hardly be convinced when the two were placed on the scale-pans of a balance at the conclusion of the experiments, and shown to be equal.

The remarkable point in these results is that, although the entire series consisted of blocks weighing 55 g. each, while three of the standards were 35 g., 50 g. and 65 g. in weight, in a large majority of trials (80%), a disc was found which seemed to correspond. This shows that the threshold of discrimination for this sense is very wide.

EXP. 2, SERIES II.

Variable size—In sight—Lever pressure.

The screen was then removed and the observer asked to select one equal to each of the standards again. The observers all very soon said that the discs of smallest diameter were heaviest. The average results are given in the following table:

TABLE V.

Set "V"—In sight—Lever pressure.

Diameter of series variable by increment of one-tenth from 29.2 mm. to 91.89 mm.
Weight 55 g.

Standards.		Average diameter of disc selected.	Difference between average and standard.
Diameter.	Weight.		
60 mm.	35 g.	81.4 mm.	+ 2.14 mm.
60 "	50 "	63.9 "	+ 3.9 "
60 "	65 "	46.9 "	-13.1 "
90 "	55 "	74.1 "	-15.9 "
30 "	55 "	37.8 "	+ 7.8 "

In the first three cases where the standards vary by a regular increment in weight, the discs selected vary by a quite regular decrease of diameter. In the last two there appears a great difference between the selections to correspond to "l" and "s." The one has just twice the diameter of the other. This comes from the double factors producing the illusion. In the other series with variable standards and uniform discs to select from, the illusion is not so great.

EXP. 3, SERIES II.

Set "V"—In sight—Lifted between thumb and finger.

The concluding experiment of the weight tests was made by having the discs lifted between thumb and finger, and alternating the standards with those from which the selections were made. In this test, where greater accuracy in selection is possible, that ought to be observable in the results. Again, if the same law is followed that held in Series I, where there are illusions they ought to be more striking in this table than in Table V.

TABLE VI.

Set "V"—In sight—Active lifting.

Diameter of series. Vary by a regular increment of one-tenth from 29.2 mm. to 91.89 mm. Weight 55 g.

Standards.		Average diameter of disc selected.	Difference between standards and selection.
Diameter.	Weight.		
60 mm.	35 g.	86.1 mm.	+ 2.61 mm.
60 "	50 "	73.8 "	+13.8 "
60 "	65 "	48.8 "	-11.2 "
90 "	55 "	86.7 "	-3.3 "
30 "	55 "	33.8 "	+ 3.8 "

From this experiment we are led to believe that the illusion comes out most strongly when testing in the manner in which we can ordinarily judge most accurately. In the first three cases the increment of weight is the same as in the previous experiment, but the decrement of diameter is much greater.

Although "l" and "s" each weighs 55 g., one of nearly three times as great a diameter is selected for "l" as for "s." In other words, with the standards of the same weight as the series to select from, there are selected those of about the same size as the standards themselves. That is, the same effect as was discovered in Table V is here noticeable, but considerably emphasized.

Résumé.

The main points of the study are these: When we study the effect of selecting from a series of blocks of uniform size, but differing in weight, those that are equal to certain standards, which differ in size (*i. e.*, in density) from the series, we are studying the effect of size upon weight.

On the other hand, when we select out of a series of variable size and variable density, but uniform in weight, the equal of standards that differ in weight, but uniform in size, the question becomes one of the influence of weight upon size.

From the results obtained it appears (1) that the effect of the latter is more marked than the former; (2) the illusions are more striking when the objects are lifted between thumb and finger than when raised by the lever-pressure method; (3) in the lever-pressure method of estimation, the illusion

does not appear in Series I at all, being overbalanced by the constant tendency to underestimate the selected weights; (4) with the lever-pressure method there is a very marked but unaccountable tendency to select a lighter weight as the equivalent of given standards; (5) in the lifting method there is no such exaggerated tendency, and the error is remarkably small; (6) these results agree in general with Dr. Seashore's (except when the lever-pressure method is used, and also with weights of uniform size), but the degree of corroboration cannot well be calculated because of the disparity of methods of experimentation.

PART II.

Study of the Effect of Contour upon Area.¹

The second part of this study deals with an examination of the possible influence that the contour of a surface may exert upon the judgment of its area. Figures of equal area but of different shapes have consequently different amounts of contour. This study was instituted to determine whether the amount or direction of the contour would prove a factor in influencing the judgment of the area. In other words, does any illusion of area ensue when the contour of a given surface is modified?

Apparatus.

In studying the effect of contour upon judging areas, the following apparatus was used: (a) A set of twenty-one squares, varying in size by a regular increment of 0.025 in area, was made from paper of a dead black color; (b) a set of twenty-one circles made of the same material and of the same areas as the squares, and varying by the same increment. Each of the figures had a white margin (of the card-board on which the black paper was pasted) of 20 mm. on each of two sides and 10 mm. on the other two sides. (For sizes see Table VII.) (c) An instrument was devised whereby a square aperture could be enlarged or contracted, still maintaining the horizontal and perpendicular direction of the sides, and also maintaining perfect right angles. The opening was changed by means of a crank, which wound up a cord attached to the movable sides of the square. A black surface, similar to the paper squares, was revealed each time by the movable sides, which were white. A millimeter scale enabled me to read at a glance the size of the square selected.

¹Dr. Dresslar has also made some study of the influence of contour upon estimation of weight. This JOURNAL, VI, 3, p. 360.

EXP. 1, SERIES III.

Figures in Terms of Squares—Display Board.

The squares were lettered in order of size, and arranged upon a display board, which was simply a board, 3 ft. x 4 ft., covered with black felt cloth. The subject was seated about two meters from the board and asked to select a square from

TABLE VII.

Dimensions of Series of Squares and Circles.

Area of Figure.	Side of Square.	Radius of Circle.
7,818.86 sq. mm.	88.4 mm.	50.0 mm.
7,921.00 "	89.0 "	50.5 "
8,209.66 "	90.6 "	51.1 "
8,372.25 "	91.5 "	51.8 "
8,628.43 "	92.9 "	52.4 "
8,836.00 "	94.0 "	53.0 "
9,070.35 "	95.25 "	53.7 "
9,312.25 "	96.5 "	54.4 "
9,523.85 "	97.5 "	55.1 "
9,741.75 "	98.75 "	55.8 "
10,000.00 "	100.00 "	56.4 "
10,225.00 "	101.25 "	57.1 "
10,500.00 "	102.47 "	57.8 "
10,684.00 "	103.75 "	58.5 "
11,025.00 "	105.00 "	59.2 "
11,289.06 "	106.25 "	59.9 "
11,576.25 "	107.60 "	60.6 "
11,881.00 "	109.00 "	61.3 "
12,155.06 "	110.25 "	62.1 "
12,387.00 "	111.60 "	62.8 "
17,762.81 "	112.98 "	63.5 "

For standards the following figures were used:

TABLE VIII.

Dimensions of Standards.

Area of Standards.	Contour of Triangle.	Contour of Oblong.	Contour of Square.	Contour of Hexagon.	Contour of Circle.
8,836.00 sq. mm.	428.7 mm.	400.0 mm.	376.0 mm.	350.4 mm.	333.0 mm.
10,000.00 "	457.5 "	500.0 "	400.0 "	372.6 "	354.4 "
11,289.06 "	484.8 "	450.6 "	425.0 "	395.4 "	376.4 "

¹ Equal to each of the three standards.

the board, which had an area equal to the standards shown. (For size of these see Table VIII.) The standards were placed, one at a time, in an irregular sequence, in the centre of the display board. As soon as a selection was made the standard was removed and another put in its place. Each one was shown but once. The average of the twenty-five answers is given in Table IX. A great regularity of answers obtains for the standard I. There is more irregularity in the selections for the middle standard, the largest result being given for the triangle, which has the largest amount of contour. But no law can be deduced, since for the other figures there is no regularity of direction. Concerning the average variation nothing very striking is deducible. With all three of the squares there is the least variation, with the first two circles the next to the smallest amount, in the first and third triangle the next, and with the first two hexagons the greatest average variation.

TABLE IX.
Averages of all Results of Comparison of Contour and Area.

STANDARD FIGURES.	Side of Av. Square Selected on Board.	Average Variation	Side of Av. Square Selected on Instrument.	Average Variation	Square root of Area of Circle Selected.	Average Variation
Triangle I,	93.5 mm.	3.9 mm.	99.1 mm.	5.6 mm.	96.8 mm.	5.5 mm.
II,	101.4 "	4.7 "	101.8 "	3.8 "	102.2 "	5.17 "
III,	103.9 "	4.3 "	105.4 "	5.23 "	105.8 "	4.6 "
Oblong, I,	94.9 "	3.8 "	99.3 "	6.3 "	94.9 "	4.22 "
II,	98.8 "	5.1 "	102.3 "	4.3 "	100.96 "	5.72 "
III,	101.8 "	5.96 "	105.1 "	4.5 "	104.9 "	4.72 "
Square, I,	93.1 "	1.7 "	100.3 "	6.3 "	96.4 "	4.82 "
II,	99.1 "	2.15 "	104.3 "	4.3 "	101.2 "	3.9 "
III,	105.2 "	2.15 "	109.3 "	4.05 "	106.9 "	4.07 "
Hexagon I,	92.9 "	4.7 "	99.4 "	5.4 "	97.2 "	3.98 "
II,	99.8 "	5.7 "	102.97 "	4.4 "	98.9 "	4.96 "
III,	104.7 "	3.68 "	106.6 "	4.26 "	106.7 "	4.6 "
Circle I,	93.8 "	3.57 "	99.0 "	6.1 "	95.6 "	2.84 "
II,	98.9 "	4.18 "	103.1 "	4.1 "	101.2 "	2.41 "
III,	104.5 "	3.92 "	106.7 "	3.34 "	108.4 "	2.84 "

EXP. 2, SERIES III.

Figures in terms of circles.

With the circles numbered in order according to size and arranged upon a display board similarly to the squares, the

same process of matching circles with the exhibited figures was gone through. The averages are given in Table IX. As in the selection of squares, no law is deducible from the constant direction of the answers with reference to contour. The average variations are a little more suggestive in their distribution. For all of the standard circles there is the smallest average error; the square comes next, the hexagon next, while the greatest variation is about equally divided between the oblong and the triangle. This has a slight indication that the greater the contour the greater the average errors. In this test the average errors are smaller than when selecting squares. However, the average of the selections is not quite so nearly accurate as in case of the squares. The difference is of no consequence. With the selection of circles there is a slight tendency to overestimation. With the squares a slight underestimation is noticeable.

EXP. 3, SERIES III.

Selection in terms of squares on machine.

In the concluding experiment the standard figures were all placed one at a time, just under the square exposure on the machine. The subjects were asked to direct me whether to enlarge or diminish the aperture so that it should just equal the area of the figure shown. The results show little more regularity concerning the relation of area to contour than is found in the other two experiments. The square is judged the greatest and the triangle the least. The average errors are larger than in the other two tests, and less regularly distributed. Throughout there is a quite decided tendency to exaggeration, which is unexplainable. Had the method of placing the standard under the aperture any appreciable effect, it would be in the opposite direction and would tend to diminish the size of the selected square. It would be on the same principle as the real but unnoticed discrepancy between the upper and lower portions of the Arabic numeral 8 and other similar peculiarities.

In the two previous experiments the standard figure, which was like the series, had considerably the smallest errors. That is, when the series to select from was squares, the squares produced smaller errors in matching, and when the series was circles the smallest errors were on the circles. But by this method no such tendency is to be found. The squares have next to the greatest average errors.

CONCLUSIONS.

1. The results show a negative conclusion so far as concerns contour acting as a suggestive factor in producing illusions of area.

2. The results show great accuracy in average estimation and small average variations.

3. In using the circular series there is an overestimation, and with the squares an underestimation. That is, the standards appear the same throughout, the circles seem smaller than they really are, and the squares seem larger.

4. The machine method results in a selection of larger squares to equal the standards. That is, the machine square seems smaller than it really is and is enlarged to equal the standard.

5. Throughout, there is a marked exaggeration in selecting the equal of the smallest standards, a slight exaggeration for the largest, and a medium exaggeration for the middle one.

To Professor Jastrow I desire to acknowledge my indebtedness for the assignment of the problem and for many of the details of method and experimentation. I also desire to express my obligation to those who favored me with their time and patience in acting as subjects.

A STUDY OF IMAGINATIONS.

BY GEORGE V. DEARBORN, M. D.,
Harvard University.

To "see things" in the ever-changing outlines of summer clouds or among the flames and embers of a fire, has doubtless in all ages been to imaginative men a source of entertainment and delight. Much of the charm of this pastime comes no doubt from the commonly accompanying circumstance of leisure, and from the novelty of exercising an aspect of mind all too little used and given freedom. Another element in the interest of the habit, however, comes from the endless variation in the forms which different persons fancy from any given contour or in any simple presented shape. For the purposes of studying the reproductive imaginations of men and women, the psychologist might well desire to take the clouds into his control and bid them serve him; but they are far beyond him and will not for a moment stay.

To reproduce, then, under applicable and controllable conditions these familiar studies of human fancy, the following simple means have been adopted, and they constitute the complete apparatus, simple enough, of the investigation. Chanee blots of ink, made by pressing gently with the finger a drop of common writing fluid between two squares of paper, furnished all the variety of outline imaginable. (More explicit suggestions for the manufacture and usefulness of these characters may be found in the *Psychological Review* for May, 1897, page 390; to this article interested readers are referred.) The bits of gummed paper 3 e. m. square bearing the blots, scarce any one of which resembled any other, were then attached to cards convenient for the hand and arranged in twelve sets of ten blots each, the members of each set being numbered consecutively from one to ten with Arabic and the sets themselves in Roman numerals. Thus the back of every blot-card bore a number by which it could be registered and identified. Figure 1 is a photograph in miniature of the whole series, the characters being numbered from above downward and the sets from left to right. Observation of the picture will show how great is the variety of design. The uncommonly great interest of the subjects in the research was largely due to this circumstance, and to secure the constant attentive

effort of the subject is often no easy matter, although sometimes this means half the research done.

The subjects were mostly students in the Harvard psychological laboratory, although professors and their wives and one Latin-school girl were among the rest. The range of ages was between eighteen and sixty-two and the average nearly thirty-five. The subjects were employed as was convenient, no selection of any sort being made, and hence they may be

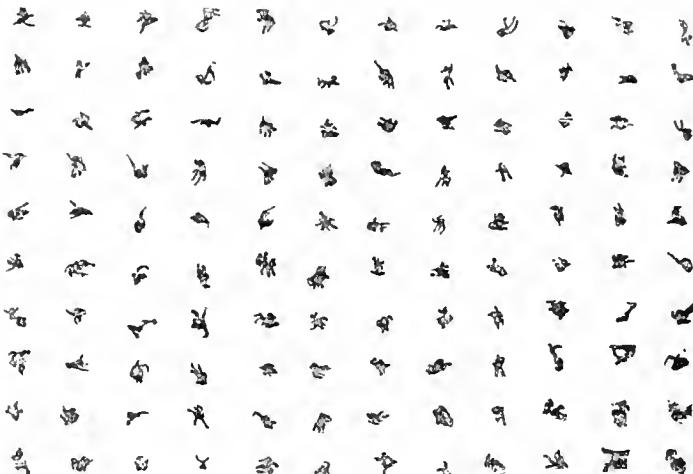


FIG. 1.

said, as far as any relation to imagination is concerned, to have been an average set from their particular social grade of culture and education. In the case of every subject some brief sketch of his or her early life was obtained as regards familiarity with various animal forms, and concerning fairy stories, mythology, and the like, and as regards possible habit of watching clouds and other natural forms as a pleasure of the imagination. It was expected that subjects raised on a farm, hunters, and artists would have a store of advantage over those of contrary habits. Among the subjects were two poets and two artists, and all of these were well toward the top in readiness and variety of response. One of these two poets made the shortest average of times, and the subject who had the longest average is a young man little fond of verse.

The experiments were conducted with the subjects always in normal condition as far as could be learned, and at an average hour of the day as regards fatigue and meals. Each was particularly instructed "to look at the blot-card always

right-side up, turning neither the card nor the head ; to try to employ the whole character if possible, not allowing it to separate into parts while being observed ; not to be too particular to get a perfectly fitting object in mind, but to tap at the moment of the consciousness of the first suggested image; to react by a sharp tap as promptly as possible ; to report each concrete object suggested as concisely as possible, with any suggested general action of the same, and, especially, only such details as occurred before reaction by the tap." The method of the experiments was, then, simply thus : A set of blot-cards being arranged in order face down and a stopwatch in hand, after a warning, Ready ! one second previous, a blot was quickly placed before the subject at his or her proper visual distance. Upon the discovery of the blot's likeness to any object, the subject tapped and, the time being registered, a brief description of the suggested object was recorded opposite the number of the character ; and so on through the entire series of 120, or, more commonly, until decrease of interest or evident slowing of reaction indicated the beginning of fatigue (which was carefully inquired after and noted), when the experiment was promptly suspended for the time. None of the subjects had seen the blots before the time of the experiment.

As would be supposed after observing the different characters as represented in the illustration, most of the replies to the general question, What is it ? were various in the extreme. This variation is least in set number one, as the blots of that file were selected and placed together as the first set, that their relative easiness might compensate for the novelty of the experience and slowness of reaction in unprofessional subjects.

The figures in the accompanying table indicate in seconds averages of the times for the ten blots composing each set. In these results the interesting cases of apparent inhibition are included, it being practically impossible to discriminate such cases of exception from slow examples of associative imagination, and no cases of inhibition being long or frequent enough to essentially vitiate the average of any subject. These periods of inhibition have an interest in themselves, for although much like ordinary cases of amnesic aphasia, they differ from them in that here the blocking seems to be among the brain paths or currents representing objects instead of among those representing words, as is the common case. Perhaps for a minute or two the subject would sit staring at the blot, but wholly unable to see any resemblance in it to any object, and this wholly independent of any inherent oddity of the character, and of inattention. The real

SUB-JECTION.	AVERAGE, AVG.	AVERAGE TIMES, IN SECONDS.												AV.
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
A.	23	5.4	4.6	4.3	9.0	4.3	7.6	6.8	8.2	6.8	14.8	8.5	7.8	7.3
B.	28	5.3	13.4	16.1	4.7	13.7	16.2	6.3	23.6	5.3	31.2	8.0	11.3	12.8
C.	21	6.3	15.0	14.2	8.4	14.1	27.5	15.5	5.1	12.4	8.4	8.1	8.6	12.6
D.	24	3.2	12.5	25.1	10.7	13.1	27.8	30.0	23.0	15.4	4.0	3.5	7.9	14.7
E.	22	5.3	4.0	9.6	9.5	10.2	12.4	19.5	9.6	7.3	12.0	11.8	8.9	10.0
F.	30	18.7	13.1	8.8	4.6	8.0	9.5	8.6	7.1	4.5	8.3	10.2	6.1	8.9
G.	27	6.3	23.3	9.8	6.2	18.6	9.4	10.2	23.1	7.1	11.5	19.4	11.9	17.6
H.	60	16.4	9.0	22.4	11.5	16.4	6.2	7.3	10.6	14.9	16.6	32.6	21.6	15.5
I.	30	25.3	30.3	25.3	17.6	5.4	11.8	21.3	14.0	37.1	18.8	19.6	14.0	20.0
J.	18	12.1	10.4	13.7	13.3	9.7	21.9	27.4	16.2	14.1	15.1	14.1	11.7	15.0
K.	29	2.3	6.7	6.1	4.0	6.3	8.9	8.8	10.7	7.5	13.8	14.6	14.7	8.7
L.	29	3.8	1.3	4.8	2.9	2.2	3.8	4.9	2.2	3.3	5.0	1.8	3.4	3.3
M.	62	1.9	3.2	8.2	2.5	2.4	2.5	2.4	1.8	2.1	1.9	1.4	1.6	2.7
N.	61	2.5	6.6	15.7	5.2	4.7	9.2	2.0	4.9	6.4	10.4	5.9	4.6	6.5
O.	39	6.5	4.7	2.1	3.0	5.9	3.3	5.3	5.9	6.7	7.0	3.3	8.2	5.2
P.	34	5.7	7.5	11.6	3.5	3.3	7.0	14.6	7.5	6.5	7.1	4.1	6.2	7.5

Grand Average, 10.3

nature of these inhibitions is a problem for further research to answer. If arising from confusion or indecision between two or more resembling objects, such confusion or indecision was in these cases wholly a sub-conscious process, appearing to the subject almost always merely as a cessation of "mental activity."

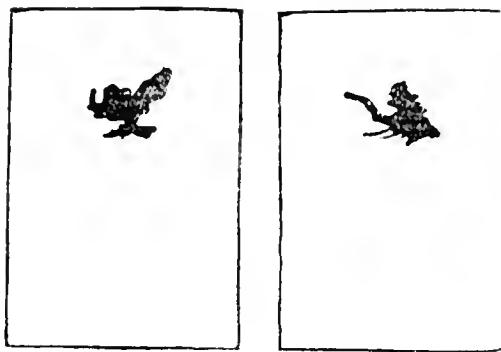
The often considerable number of vacant seconds which elapsed between the application of the stimulus and the reaction image, offers a striking illustration of the entire sub-consciousness of the processes of reproductive imagination, but including in these cases much more. Here was presented a blot of ink, perceived by the subject; the next thing in his consciousness was a name of some object resembling in some respect or many the stimulus, so that a complicated process necessarily intervened. Many ancient pigeon-holes of the brain must have been searched, and a comparison made with the contents of each, followed by a judgment of greater agreement in some one case, a choice thereof, and the calling-up and utterance of a name, which again became consciousness. And this often in a fraction of a second. Such, we may conjecture, is the general process, although the many attempts at introspection gave wholly negative results. Frequent inquiry was made as to how, in what form, the suggested object came into consciousness, and the most frequent reply was that a name, articulate, visual, or auditory, was the first of

the object experienced. Sometimes, then, it was once or twice said, the connotations of the object developed. In some cases aphasia occurred and a hazy likeness of the object coming hovered for a few seconds or less before the mind. Here is a problem for research.

Instruments of precision for measuring small periods of time were not needed in these experiments, but intervals of not over half a second appeared in several instances, such reactions being as fast as regular time-reactions with judgment or choice, and much more characteristic of the reacting subject than of the blots on which the reaction occurred. The longest time required, three minutes very nearly, was by the subject with next to the longest general time average also; the two next longest were by two students of decidedly "intellectual type." Neither age nor sex shows a distinct influence in these quantitative results; habits of living, on the other hand, are clearly recorded in the figures as confirmed by knowledge of the various subjects' mental modes and occupations. The intellectual type appears in the numbers with like corroborative evidence. From the grand average of all the subjects' times, about ten seconds, it is apparent that the reactions were slower than one might *a priori* estimate from a study of the blots. Facility developed noticeably in some cases. It is curious to observe that an equal number of subjects were above and below the quantitative average; also that the slowest and fastest were nearly an equal number of seconds from the mean time, which thus doubly appears to be a true average time of these 1920 reactions. As a comparative mental test, this mode of experiment would seem to be valuable, representing accurately the mental functions upon which wit and mental liveliness depend.

The qualitative portion of this research has more of interest than the quantitative, howbeit its results are not statable in exact terms nor expressible in figures. The qualitative side better, however, suggests the mysteries of association and of the imagination, deep in the nervous substance, which future psychologists may explain. Each subject, it will be remembered, was instructed to report the *first* object which the blot suggested to him in each of the 120 cases. A comparison of these object-images gives, therefore, curious and interesting results, and leads into mazes of scientific conjecture.

In the case of no blot did over 40 per centum of the subjects agree on any one suggested object. In several instances no two of the subjects were reminded of the same thing. These two extreme blots are reproduced in Figure 2, the right blot, numbered X.10, having given the 40 per centum of agreements, and the other, XII.7, being one of those upon



XII. 7. X. 10.

FIG. 2.

whose name no two agreed. Critical study of their outlines gives only one key to this great difference in difficulty, namely, that the one upon which there was agreement strongly suggests the familiar figure of a man (with upturned coat collar).

From out the 120 blots three have been chosen here as examples for a full report of the subjects' answers, the times being also given for greater completeness. These three characters are reproduced in Figure 3, and their respective descriptions follow:



III. 6. VIII. 10. IX. 4.

FIG. 3.

III.1.

SUBJECT.	IMAGINED OBJECT.	Times. Seconds.
A.	Cabbage head.	3.
B.	Animal with mouth open.	46.
C.	Fairy on a cloud.	11.
D.	Woman, seated, basket of vegetables in her lap.	12.
E.	Top of an Indian's head, nose swollen.	4.
F.	Grotesque Indian's head.	22.
G.	Rabbit sitting hunched up.	16.
H.	Potted plant on the ground.	7.5
I.	Rooster sitting in a bunch of vegetables.	44.
J.	Grinning head of a beast.	3.
K.	Head of chicken with a top-knot.	2.
L.	Monstrous man's head.	1.5
M.	Flower.	2.5
N.	Cock's head, comb erect.	4.
O.	"Punch."	1.5
P.	Head of a woodcock.	6.

VIII.4.

SUBJECT.	IMAGINED OBJECT.	Times. Seconds.
A.	Puritan scold about to be ducked.	9.
B.	Woman extending her hand.	2.
C.	Veiled woman on a stool; basket at her feet.	8.
D.	Woman on stilts.	16.7
E.	Mermaid enveloped in her hair.	6.
F.	Fore part of a grazing deer.	3.3
G.	Bear.	4.
H.	Man sitting on the limb of a tree.	3.8
I.	Monkey on a three-legged stool.	4.5
J.	Dog, tail very straight.	7.
K.	Man digging.	3.
L.	Girl in a high-chair throwing something into a basket.	1.
M.	Chimpanzee.	4.
N.	Old woman sitting on a tub on two legs; children at right.	1.3
O.	Person sitting on a person in a chair.	4.
P.	Woman sitting on a rock.	4.5

IX.10.

SUBJECT.	IMAGINED OBJECT.	Times. Seconds.
A.	Demon on a beast.	4.
B.	Monster's head.	16.3
C.	Head of an Arab.	8.
D.	Running animal frisking.	2.
E.	Girl in a tall cap, seated.	4.
F.	Running pea-fowl, head on one side.	6.2
G.	Chimera.	11.5
H.	New style lady's bonnet.	70.
I.	Head of some one-eyed creature.	33.5
J.	Bat, flying.	47.8
K.	Two shrimps.	20.
L.	Child falling from a tub, falling from overturning stool.	2.
M.	Half of a sweet-pea bloom.	3.5
N.	Snake coiled around a stick.	3.
O.	Horseshoe-crab.	5.
P.	Human head (left part of blot only).	21.

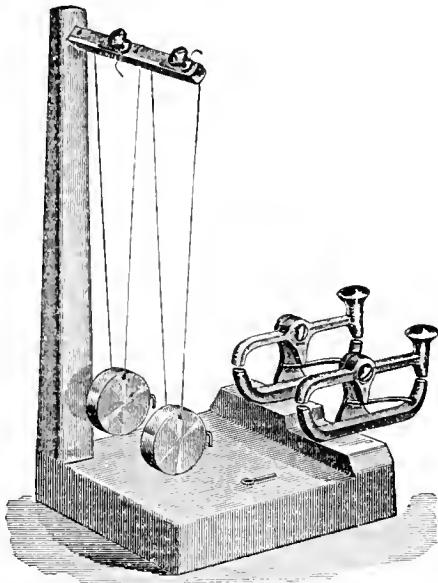
Why one subject should see in a blot a "cabbage head" and the next an "animal with his mouth open," or why a professor should be reminded by a blot of "half a sweet pea blossom" and his wife of a "snake coiled round a stick," of course no one can at present pretend to explain. There is a temptation in such cases of association as these to call the results the choice of chance, but this means too little—or too much. It is clear that, as a general principle, the experience, and especially the early experience, of the subject has important influence. For example, study of the records shows that subject H., a purely domestic woman, is reminded most often of domestic objects; while subject O., who is an artist and student of mythology, sees in the blots many picturesque and fanciful things. The difference between the imaginations of the country and city bred is clear. Altogether there is evidence here that the laws of the reproductive imagination, still for the most part hid in the neural paths, are substantial laws, which may one day be found entirely out and reduced to words and to more or less of mathematical certainty of statement. Meanwhile it is something to establish, if possible, in a manner unmistakably demonstrable, the empirical conditions under which this "faculty" of mind performs its marvelous combinations and effects, for the imagination is one of the most interesting as well as most important phases of mentality.

In particular would it be interesting to know to what degree, if at all, the fixed ideas, delusions, and changed emotional conditions of what the Germans term conveniently *der Wahns*, influence and subvert the reproductive imaginations of the persons who are the victims of these obsessions and delusions, fixed into their mental natures deep as life. Perhaps an attempt to answer these interesting inquiries may form the substance of another research conducted with this same set of blots.

THE VERNIER CHRONOSCOPE.

By E. C. SANFORD.

Some years ago, the writer described a simple chronoscope on the principle of the vernier, capable of measuring short intervals of time in hundredths of a second.* The instrument was crude, and probably has never been put to serious use, but the need of a number of time instruments of some sort for a brief practice course at the Clark Summer School of 1897 led to a second attempt and finally to the instrument pictured and described below, which has proved itself very satisfactory in actual use and won commendation from several who have seen it.



The essential part of the instrument is the pair of unequal pendulums at the left. The longer of these is of such a

* This JOURNAL, III, 1890-91, 174. The idea was borrowed from the astronomer Kaiser, who used it more than forty years ago in studying "personal equation."

length as to make one complete swing (*i. e.*, to traverse its arc and return to the same point) in 0.80 seconds; the shorter makes a complete swing in 0.78 seconds, thus gaining 0.02 seconds at each of its swings, and fixing the unit of measurement of the instrument at one-fiftieth of a second. With these rates, if both pendulums start together, the shorter will gain a whole swing of the longer, and they will be together again after forty of its swings; $0.80 \div 0.02 = 40$. If the shorter starts later than the longer, it will gain as before at the rate of one-fiftieth of a second per swing; and in order to know in fiftieths of a second the interval by which it started later, it will only be necessary to count its swings until it catches up; and in general to measure any short interval, it will only be necessary to start the longer pendulum at the beginning and the shorter at the end, and to count the swings of the shorter up to and including a coincidence. The number counted is the interval expressed in the units of gain, that is, in fiftieths of a second.

The counting of the shorter corresponds to the common usage in counting a vernier, but in this instrument the counting of the longer pendulum is from its position somewhat easier, and as the number of swings is the same in either case, no error is introduced by so doing. In the remainder of the description it is assumed that the count is made upon the longer.

In measuring intervals of over 0.80 seconds, the long pendulum will complete one or more swings before the short pendulum starts. When this happens a difference must be made in the counting. For each whole swing made by the long pendulum, *before the short one starts*, forty units must be added to the value given by the count while both are in motion. Suppose, for example, that the long pendulum has made one swing before the short one starts, and that six more swings are made before the coincidence, the total time would be $40 + 6$ units of the instrument, or 0.92 seconds, in the perfectly adjusted instrument. If the long pendulum should make three whole swings before the shorter starts and then twenty more swings to the coincidence, the time would be $3 \times 40 + 20 = 140$ units of the instrument, or 2.8 seconds. With a little care the measurements of these longer times need offer no difficulty.

How the adjustments of the pendulums are made will be explained after the construction of the instrument has been described.

The Construction of the Chronoscope.

The base of the instrument is of cast iron (4 $\frac{3}{4}$ inches long,

4 inches wide and $\frac{1}{8}$ of an inch thick). On one corner of it rises a column ($7\frac{1}{2}$ inches high, above the base) which, with the little platforms supporting the keys, is cast in one piece with the base.

From the top of the column an arm extends forward over the base $3\frac{1}{2}$ inches. This is made of quarter-inch square brass rod and is set cornering so as to allow the threads of the pendulums to hang from an edge. One end of each thread is tied fast through a hole in the arm, and the other is clamped under the head of the corresponding screw on the upper side of the arm, thus providing an easy adjustment in length. Both the tied and the clamped ends pass up over the upper edge of the arm and down on the right side, where they lie in four narrow file cuts to prevent them from slipping laterally and thus altering the length of the pendulums. This is a slight feature in the construction, but important for accuracy. The threads are ordinary silk butt n-hole twist, red for the long pendulum and blue for the short. The bobs are brass disks a little over an inch in diameter and three-eighths of an inch thick. The length of the longer pendulum is approximately $6\frac{1}{2}$ inches, from the edge of the arm to the center of the bob; that of the shorter, approximately $5\frac{1}{2}$ inches.

The pendulums are released from the keys at the right in the cut. Each of these catches between its lips, represented as half open, a little loop of wire like that lying upon the base, and into the loop is dropped the hook on the side of the bob. When the knobs of the keys are depressed, the loops are released and the pendulums start. The structure of the keys is very simple. The upper bar turns on the screw as a pivot, and is held in either the closed or open position by the spring, which acts upon the downward projecting cam.* A round brass post extends downward from the under side of the lower bar, fitting into a hole of the same size in the base, and is held in place by a set-screw not shown in the cut. This arrangement provides a vertical adjustment of the keys, by which they are easily brought into the right relation to the pendulum.

The instrument in this form can be used for reactions with auditory or tactile stimuli; for use with visual stimuli, a small addition is required which is described below, in connection with the method of using the instrument for reactions to visual stimuli.

*This plan was suggested by Prof. Jastrow's reaction key, this JOURNAL, Vol. IV, 1891-92, p. 210.

Adjustment and Control of the Instrument.

The adjustment and control are as simple as the construction. The long pendulum must first be brought, by varying its length, to swing in 0.80 seconds, that is, 150 swings in two minutes. If the timing is done with a stop watch, this is easy for a single observer; if with an ordinary watch, it is a little more convenient to have the time kept by one observer and the count by another. The pendulum is started; observer A taps upon the table for the beginning of the two minutes; observer B begins the count, calling the first count "naught," and continues till A taps for the end of the two minutes. The pendulum is then lengthened or shortened, as the count indicates. It would be a long process to get the adjustment so exact as to give just 150 swings, but that is not necessary. It is better to accept an approximate adjustment (*e. g.*, 149 or 151), and to apply an arithmetical correction later if necessary. The short pendulum is better regulated by the long one than directly by the watch. Both pendulums are set swinging, and the count started at a coincidence (called "naught") and the counting continued till the pendulums are exactly together again, which should happen at the end of the thirty-ninth swing of the longer. As before, an approximate adjustment is sufficient.

Adjustment in the last case is a somewhat more delicate matter than before, and if time is short, one which brings a coincidence at the thirty-seventh or forty-first swing will serve. It is more important to know the exact swing upon which the coincidence occurs than it is to make it occur upon a particular one. If greater accuracy than can be reached by a single count is desired, the counting may be continued through two or more periods. An adjustment giving a coincidence at $39\frac{1}{2}$ swings, for example, would show the second coincidence at 79, the third at 118.5, and so on.

The adjustments can be made more rapidly than might be inferred from this description of them, and once made require no more than an occasional counting to make sure that they have not changed.

The arithmetical correction above mentioned is easy to obtain. Suppose, for example, that the long pendulum is found to swing 148 times in two minutes and that coincidences occur every 37 swings. This will mean that the time of a single swing of the long pendulum is 0.81 seconds, and that the short pendulum makes 38 swings to 37 of the long.

The unit of the instrument is then 0.0213 ($0.81 \div 38 = 0.0213$), instead of 0.02 , as it would be if exactly adjusted. In this case the final records would be reduced to hundredths of a second by multiplying by 2.13 instead of by 2 . For many demonstrational purposes no correction at all is necessary, all records being kept directly in the units of the instrument.

Methods of Using the Instrument.

For simple reactions to auditory stimuli, the method of operation is as follows: The subject and operator being in place (the latter with closed eyes) and the pendulums hooked into the loops, the operator gives a "ready signal," and a second or two later taps his key smartly with the back of a pocket knife or other convenient bit of metal. The tap releases the long pendulum, at the same time producing the sound to which the subject reacts by pressing his key; the operator counts the swings of the long pendulum till the two are in coincidence, and the number is the reaction-time in the units of the instrument.

Sometimes the coincidence seems equally good on two swings. This indicates that the real coincidence fell between them, and the record is to be made accordingly. If it has seemed to occur on both the 10th and 11th swings, the record is 10.5 swings. For this reason it is well not to cease counting at the first sign of coincidence, but to continue till separation is evident, noticing, of course, to which swing, or swings, the coincidence really belongs. The counting and the judging of coincidences require a minimum of practice, but the knack is very soon acquired.

For reactions to visual stimuli, two small changes in the apparatus are needed. A screen must be set up between the subject and operator, and an arm attached to the operator's key for presenting the visual stimuli at the instant of the release of the pendulum. For holding the screen, a vertical saw-cut has been made in the base of the instrument, half way between the keys and extending an inch or more toward the center. A stiff piece of cardboard a foot or so square set into this cut will stand of itself and furnish all the screen necessary. (The cut is unfortunately not shown in the illustration above.) The arm for carrying the visual stimuli is a vertical brass rod, about five inches long, screwed into the operator's key just above the pivot. At its upper end, this rod carries a spring-clip, into which are set the bits of black, white, or colored cardboard, about an inch square, which serve for the visual stimuli. When the knob of the key is depressed, the rod is thrown to the right and

the stimulus card brought before a suitable opening in the screen. The movement at the top of the rod is only about half an inch, but this is sufficient for most purposes. Since the pendulum is released the instant the depression of the knob begins, the opening must be rightly placed and the edge of the stimulus card must lie as near to it as possible. To facilitate this the card is also brought as close as possible to the screen by giving the rod a double bend toward the other key. The noise produced by the striking together of the right ends of the bars of the key when the key is suddenly opened is a disadvantage in visual experiments, and may be obviated by slipping over both (as if to connect them) a half-inch bit of quarter-inch rubber tubing, in the middle of which a little cotton has been placed. The noise may be very much diminished in this way without too great reduction in the movement of the upper end of the arm.

Reactions to touch, or more exactly to pressure, may be tried by having the subject place one fore-finger under that of the operator on the operator's key. He will thus receive a pressure in it at the instant that the operator's pendulum is released and can release his own pendulum with the other finger.

Reactions involving discrimination and choice, in Donders' form (*i. e.*, by reacting to only one of two or more stimuli and refraining from reaction to the rest), can easily be tried with the chronoscope arranged for visual stimuli. The number associations (adding, subtracting, multiplying, dividing, squaring, etc., etc.) can also be tried with the same arrangement, if the problem is given in such a way that the subject cannot begin to solve it till he is shown a digit through the hole in the screen. For example, the subject is told to add to 17, a number to be shown. As soon as the operator's key is depressed, he sees the digit required and begins his adding, pressing his key and announcing the result simultaneously when he has reached it.*

With experiments in an auditory form, the range of application is still wider, any sort of association time being measurable when the operator makes the depression of his key coincide with the calling of the stimulus word, and the sub-

* It might seem sufficient for the subject to press his key without calling out the result, but there is probably less tendency to anticipatory reactions when vocalization is required, and the subject is in a better position to report upon his success in making the depression of the key coincide with the termination of the mental task.

ject makes the depression of his coincide with his response.*

The following points in regard to the management of the chronoscope should be regarded. In preparing the instrument for use the operator should see that the keys are so set as to release the bobs with as little independent motion as possible, and that the bobs hang straight in the middle of their threads when at rest. The keys should catch the wire loops at such a point as to bring the threads of both pendulums approximately into the same plane. It is easier to judge the coincidences by sighting across the threads than by watching the bobs. The bobs show a tendency to wear the threads unless the holes in them are carefully smoothed, which probably could be prevented by waxing that part of the thread. It will be found convenient, though by no means necessary, to clamp the instrument to the table on which it is used to prevent the subject from displacing it by over-vigorous reacting..

The instrument can easily be given a form in which the bobs are released from electro-magnets, and one of that sort is now in the Clark laboratory. Such an arrangement, however, introduces not only the time error of the magnets—a small matter probably in any use to which such an instrument would be put—but also requires additional keys, batteries and subsidiary apparatus, which would multiply the cost beyond reason. The instrument has been spoken of as a demonstrational instrument, and such is its primary purpose, but it is evidently capable of serving for research in any case where a unit of one-fiftieth of a second is sufficiently small.

* For valuable suggestions, both as to construction and methods of use, the writer is indebted to Prof. E. B. Titchener, in whose "Primer of Psychology," the instrument and experiments are also described.

AN OBJECTIVE STUDY OF SOME MORAL JUDGMENTS.

BY FRANK CHAPMAN SHARP.

In an article in the *Philosophical Review* for May, 1896, an attempt was made to explain, in part at least, the continued existence, through generations of controversy, of incompatible theories of the moral life. It was shown that thinkers had failed to reach conclusions commanding universal consent, largely because they had based their descriptions and consequent explanations mainly, if not entirely, upon the data supplied by their own consciousness. This method of procedure might have done little harm had its implied postulate, the absolute uniformity of the moral nature, been true, but facts were adduced which seemed to force us to the conclusion either that the great majority of moralists have been and are either hopelessly incompetent or careless, or both, or that there exist different types of moral judgment, which are represented with varying degrees of completeness in different persons. If we accept the latter alternative we shall cease to wonder that those who never turn their eyes to the fields that lie beyond the narrow boundaries of their own lives, should bring in reports that are apparently impossible to harmonize. If this position be sound, the great desideratum in ethics to-day is a complete knowledge of the phenomena of the moral experience, as these are to be found in the men and women—and children—about us. Works on the morals of savages or of semi-civilized peoples, works on European morals in past centuries, valuable as these may be, are not sufficient. Even where they are absolutely reliable, the information they give us is still too meagre; we may almost say that they fail entirely to show us “the great heart of the machine.” The same criticism holds of the material supplied by the biographies and autobiographies of the great dead. In their best estate they give us nothing more than passing glimpses of the life within. What is needed to-day is detailed information touching every phase of the ethical experience, including the apparently insignificant and uninteresting as well as the fundamental and impressive. Even if the sci-

tific problems of analysis and explanation be relegated to the background, as is the tendency at present, and all interest be concentrated upon the determination of the *summum bonum*—that which gives conduct its ultimate value,—little progress toward a final agreement is to be hoped for between the members of opposing schools, except as both parties are forced to face the question of the nature and extent of possible divergencies from their own standards and modes of thought.

The present article is an attempt to suggest a method for investigating the material which has been thus neglected. Since it aims primarily to set forth the validity and usefulness of a method rather than to add to the already acquired stock of information (though we believe it will not be found wanting in this respect), we have selected as its subject the examination of certain assertions in Martineau's "Types of Ethical Theory." These assertions form the main part of the foundation of his system, and yet the author presents us with no other evidence of their universality than his own emphatic *ipse dixit* and the familiar but now rather worn assurance that the existence of the moral life stands or falls with them. The writings of the great apostle of liberal theology have been chosen for our purpose, mainly because they belong to that small class of contemporary works that throw the emphasis upon the scientific as opposed to the speculative problems of ethics, that seek primarily to discover the conditions under which moral judgments arise rather than to ask for their ultimate validity. Not that this last question is not of the highest importance (Martineau himself by no means neglects it), but the more pressing need *at present* is for careful study in the other direction.

The specific theses which it is proposed to consider are four in number. The first has to do with the fundamental nature of moral judgment. Motives, not actions, are declared to be its objects. When two incompatible impulses appear in consciousness and struggle with each other for supremacy, we become directly aware of their relative excellence or of their comparative moral worth. "This apprehension is no mediate discovery of ours, of which we can give an account; but is immediately inherent in the very experience of the principles themselves—a revelation inseparable from their appearance side by side. By simply entering the stage together and catching the inner eye, they disclose their respective worth and credentials."^{*} The

^{*}"Types of Ethical Theory," Vol. II, pp. 44, 45.

significance of these statements will appear more clearly if we bring them face to face with a criticism upon them urged by Professor Sidgwick. The determination of what is right will not, he thinks, except in the most trifling cases, take the form of a direct comparison of the motives which primarily urge us to action. For instance, if the duel is started between resentment and compassion, or between love of ease and love of gain, "the struggle will not be fought out in the lists so marked out, since higher motives would inevitably be called in as the conflict went on, regard for justice and social well-being on the side of resentment, regard for health and ultimate efficiency for work on the side of love of ease; and it would be the intervention of these higher motives that would decide the struggle, so far as it was decided rightly. . . . So that the comparison ultimately decisive would be not between the lower motives primarily conflicting, *but between the effects of the different lines of conduct to which these lower motives respectively prompt, considered in relation to whatever we regard as the ultimate end or ends of reasonable action.*"* If in common with the representatives of many otherwise conflicting schools we call this end the interests or the welfare of those thereby affected, the problem to be solved may be formulated as follows: When two alternatives present themselves before a man for moral evaluation, is his judgment determined by noting their relative excellence or admirableness in themselves considered, or does he ask what the effects of the two courses of action will be upon the welfare of those thereby affected?

The second assertion to be tested affirms the absolute uniformity of moral judgments when the problem to be solved has been stripped of all irrelevant considerations with regard to the working of external forces and has been reduced to a question of the relative worth of the competing motives or groups of motives.** It must, of course, be granted that the person judging has some knowledge of the meaning of the terms involved, and furthermore that his inward eye has not been dimmed by habitual disregard of the dictates of conscience. These conditions being granted, all apparent variations from a uniform standard are due, we are told, to the fact that moral judgment involves a comparison of two elements, and often but one of these is explicitly put forward. If I ask: Was B the right spring of action to follow under the given circumstances?

*"Methods of Ethics," 4th edition, p. 372.

**"Types of Ethical Theory," Vol. II, pp. 77 f.; p. 102.

one person may indeed answer yes, and the other no. But the contradiction is only apparent. For the first party was mentally comparing it with C, and the other with A. No wonder, then, that the former looked upon it as the higher alternative and the course of action it urged to as right, while the latter judged this same course of action to be wrong.*

Furthermore, the revelation of the moral worth of the springs of action is asserted to be immediate, because direct. "The moment this condition is realized (*i. e.*, when the incompatible impulses enter consciousness), we are sensible of a contrast between them. . . . requiring a phraseology for its expression such as this: that one is *higher, worthier* than the other. . . . There is no analysis or research required; it is a choice of Hercules, only without the reasoning and the rhetoric; the claims are decided by a glance at their face."**

From the uniformity and immediacy of the moral judgment follows directly its certainty, the sense of necessity, untroubled by a single doubt. If the matter is decided at the first glance without analysis and without reasoning, and if the decision will hold for all time and in every place, the impulses under inspection remaining identical, then evidently no place is left for hesitation or uncertainty. As well might we doubt whether the sensation of pure white on a black background involved the consciousness of two sense qualities or only one.***

To test these statements a series of ten questions was recently given to the members of the psychology classes in the University of Wisconsin, resulting in the receipt of 152 sets of answers, fifty-seven from young women, ninety-five from young men. The students were members of the junior and senior classes and averaged about 21 years of age. As far as is known, no one of them had previously made any study of theoretical ethics, or had, at most, anything beyond a casual acquaintance with any department of the literature of the subject. They were requested to prepare their replies without consulting with any one, in order that these might represent the result of their own unassisted judgment. They were urged to state, as far as possible, the reasons for their conclusions with the utmost fullness; so generously was this request complied with that their papers averaged between 400 and 500 words in length. In order to encourage complete frankness, assurance was

**Ibid.*, pp. 61 f. Note the examples given.

***Ibid.*, pp. 44, 45.

****Ibid.*, pp. 72, 454.

given that under no circumstances would the identity of the writer of any statement be revealed. It should be added that the students had no idea of the use to which their work would be put and no reason to suppose that it would ever be examined by anyone besides myself. The temptation to talk solely for effect was thus reduced to a minimum. The questions were presented to them in type-written form during their regular recitation hour. They were requested to hand in written answers at the next meeting of the class, three days later. Beyond the directions already referred to, they had simply to be told to indicate the time after each question which was required for its decision; to mark each answer which they did not feel perfectly certain about, "doubtfnl;" and finally, if unable to come to a conclusion in any case, to state this fact instead of merely passing it by without mention. Practically no explanation was added to the printed text, beyond the information that numbers II, III, and with slight additions, I, were taken directly from life; and furthermore that the circumstances described in I (c) were very nearly realized in a railroad wreck in Ohio a number of years ago.

The questions were as follows:

1. Several years ago in a railroad wreck a lady was imprisoned in the débris in such a way that escape was impossible. Her husband, who might have extricated himself with an effort, deliberately chose to remain and die with her, in order that he might give her the support and comfort of his presence in her last moments. She herself, we must suppose, was not aware of the possibility of his escape, otherwise his aim would of course have been defeated. What is to be said of the moral character of his choice in each of the following cases? (a) If he was a clerk with the expectations of the average of his class and had no family ties apart from his wife. (b) Position as in (a), but he had a mother living with him in his home, who was very much devoted to him, but not dependent upon him for support. (c) Position again as in (a). He had a distant relative, a lady who was an invalid and absolutely dependent upon him for support. (d) If he had been a clergyman doing a great deal of good. (e) If he had been a Morse, conscious that he was on the eve of the solution of the problem of the electric telegraph. (f) If he had been an artist of very exceptional talents.

2. (a) In a small western village a switchman was just about to turn the switch for an approaching express train when he saw his little son, his only child, playing upon the track. The choice had to be made between the life of the babe and the lives of the passengers. What ought he to have done? (b) In the case just cited the man was on duty. What should be the decision under the following circumstances?

A drunken switchman has left the switch open. A man who lives near the tracks notices the open switch on his way home from work and is just about to turn it to save the train, when he sees his only child upon the track just in front of the engine. The alternative is as in (a).

3. A young man taught for a year in a private school in New York with a great deal of success. At the close of the school year he was complimented highly by the principal upon the character of his work, and, although no definite engagement was made, he was led to believe that his services would undoubtedly be desired for the ensuing year. All summer he tried to bring about a definite understanding with his employer, but letters mysteriously failed to reach their destination, etc., till when the end of September had come, no contract had been agreed upon. Then at last he succeeded in getting a personal interview with the principal. The latter offered him a salary of \$600, only two-thirds the amount he had received the year before, claiming the services in question were worth no more to him. At this the young man could only believe he had been tricked. He had no friends in the city, and his parents in a distant part of the country were unable to support him. He was just graduated from college, and had had no experience in other lines of work. Almost all school positions were already filled. In each of the following circumstances what would it have been his duty to do, or is he under no moral obligation one way or the other? (a) If he had had \$500 in the bank. (b) If he had had only enough to support him for a month or two. (c) If he had had \$500, but a wife dependent upon him for support. She, however, being willing to have him do whatever he thinks right. (d) Money enough for only a month or two, and a wife as in (c).

4. A timid child is offered some money to go into a dark room in a distant part of the house and remain there five minutes. Has he done wrong if he goes? Or is no moral question involved? The child is assumed to be old enough to be able to distinguish between right and wrong.

5. The following might have happened at the Johnstown (Penn.) flood. A man found he had just time either to warn his wife or two other women (not relatives). Both these women have family ties, etc., so that looked upon purely from an objective standpoint the death of anyone will involve as great a loss to all concerned as the death of another. What is it his duty to do?

6. In 1773, at the age of 47, John Howard began what was to prove his life work, the investigation of the prisons of England, which finally resulted in a complete revolution in the English prison system. The prosecution of this work necessitated constant traveling from place to place, and in consequence he was compelled to leave his eight-year old son under the care of strangers, for the mother had died several years before. At an early age the boy became dissipated, and before he was twenty-one was morally a wreck. The father knew what his son's habits were. On the other hand he had no evidence whatever that anyone else stood ready to take up his work for the prisoners in case he abandoned it. Suppose that he was fully convinced that under his own guidance his son might be trained to lead an honorable, moral life, was it his duty to drop his work for ten or fifteen years till his son had grown up, and thus delay and perhaps postpone indefinitely the possibility of the needed reforms, or did his duty lie with the work he had begun?

7. In Shakespeare's "Tempest" Prospero, Duke of Milan, leaves the government of the city entirely in the hands of his brother in order that he may devote himself exclusively to what may be called scientific pursuits. In other words he gives up political power in order to gain knowledge and culture. Provided his brother had been just as good a ruler as himself, and was glad to assume the duties of the office, was such a choice praiseworthy or blameworthy (morally), or was it morally indifferent?

8. It is related of the English statesman, William Pitt, that he once fell in love with a young lady, but would not permit himself to seek to win her because he believed marrying her would hinder his advancement in public life. Was such a decision morally praiseworthy, or was it wrong, or was it morally indifferent? It is assumed that in making his decision he was moved mainly by ambition, and not by a design to be useful to his country. If you consider no moral question was involved in his decision, would you think the better of him for choosing one or the other of these alternatives? If so, which?

9. If you had a friend who was a Spiritualist, would you consider it your duty to attempt to undeceive him, as long as his beliefs were harming no one else, in case that by so doing you felt certain you would (a) make him permanently unhappy, or that (b) you would weaken his moral character? Would you consider it *wrong* to do so in (a) or (b)?

10. A young man with talents adapting him about equally for trade or study, who is just about to enter college, is offered a business position that promises to lead to wealth. The demands that will be made upon his time and energy are so great that he will be unable to carry on his studies in any form. The culture he will get out of the proposed career is as near zero as possible. Is he morally blameworthy if he accepts it? If not, would you think less of him if he accepted?

In the tables, which summarize results, *R* stands for the judgment, "He did right"; *W*, "He did wrong"; *D* means that the person interrogated could not come to a decision; *X*, that no moral question was involved. The person before whom the alternatives are supposed to have been placed is therein assumed to have chosen as indicated, in each of the following cases: I: The husband remained with his wife; II: The father saved his child instead of the train; III: The young man refused the position; IV: The child refused to go into the room in order to gain the money offered him; V: The man saved his wife; VI: Howard devoted himself to the reformation of his son (this form was adopted for the sake of uniformity with II and V); VII: Prospero devoted himself to his studies; VIII: Pitt chose to gratify his ambition; IX: I conceive it to be my duty to attempt to undeceive my friend; X: The young man declined the business position.

It will be convenient to begin our investigation with a study of the alleged uniformity of moral judgments. For this purpose the replies to questions I, II, IV, V, VI, and IX supply the best material, because these offer comparatively small opportunity for differences in interpretation, and where the grounds for the decision are stated with any degree of fullness, ambiguous answers can therefore be easily eliminated. The following table gives a summary view of the results obtained:

	CLASS (1).			CLASS (2).			
	Women.	Men.	Total.	Women.	Men.	Total.	Final Total.
I (a) R	8	6	14	16	17	33	47
W	7	25	32	5	12	17	49
D	1	1	2	0	1	1	3
(b) R	14	6	20	6	7	13	33
W	14	41	55	6	13	19	74
D	1	0	1	1	1	2	3
(c) R	9	4	13	0	1	1	14
W	19	44	63	13	20	33	96
D	1	1	2	0	1	1	3
(d) R	11	5	16	1	4	5	21
W	16	41	57	13	17	30	87
D	1	0	1	0	1	1	2
(e) R	11	6	17	1	4	5	22
W	16	44	60	10	16	26	86
D	2	0	2	1	2	3	5
(f) R	12	6	18	1	6	7	25
W	15	37	52	11	17	28	80
D	2	0	2	1	1	2	4
IV R	6	10	16	5	4	9	25
W	0	0	0	1	4	5	5
X	9	8	17	27	52	79	96
D	0	0	0	1	2	3	3

	Women.	Men.	Total.
II (a) R	0	3	3
W	56	85	141
D	0	1	1
(b) R	9	21	30
W	43	66	109
D	4	2	6
V R	41	68	109
W	11	20	31
D	3	3	6
VI R	33	31	64
W	14	47	61
D	2	3	5
IX (1) a R	3	10	13
W	42	69	111
D	3	1	4
(1) b R	1	1	2
W	44	78	122
D	3	2	5
(2) a Yes	29	53	82
No	7	5	12
D	1	0	1
(2) b Yes	39	60	99
No	4	3	7
D	1	0	1

In question I the intention was to assume that the man by remaining in the wreck really would have done more to comfort the last moments of his doomed wife than by

leaving her to die alone (human nature being what it is) and that this was the consideration that led him to remain. Furthermore, that the value of his life, whether to society or to individuals, would have outweighed in each case the value to his wife of his presence at her side during the short time that was to elapse before death came to claim his own. Of course we are not unaware that many moralists believe that they believe that all such comparisons of values is impossible. We are not here concerned to deny this doctrine. 129 writes: "It seems to me that the good he could do by living would in every case far exceed the good done his wife by remaining with her." The problem is: This premise, as well as the others just mentioned, being granted, what will be the decision of different persons upon the morality of the choice? All papers that failed to face *this* question were thrown out. Among them were of course those who denied that the husband, by remaining with his wife, would really have comforted her, or at least to the same extent as would have the knowledge of his safety (a proposition which for many or perhaps most women would doubtless be true). Again, in twenty papers his action was denominated suicide, and as such condemned without qualification. These were without exception rejected, though it is possible that in the minds of some of the writers, this subsumption did not stand as the sole justification of the reprobation expressed. Finally all those were regarded as not meeting the conditions imposed by the problem that held in (a) that the life of a man in a clerk's position, with no family ties, would probably be of no special value to the world. After excluding all doubtful cases, forty-eight answers to (a) remained that gave evidence, apparently beyond the possibility of a doubt, of a complete understanding of the question in the form intended; to (b) there were seventy-six such answers; to (c) seventy-eight; to (d) seventy-four; to (e) sixty-nine; to (f) seventy-two. These are designated in the table as class (1). In addition there was a large percentage of papers whose answers were too indefinite, mainly because of brevity, to make possible any opinion whether they were a reply to the real question or not. They appear in the table as class (2). If the results thus obtained are of any value whatever, it will be seen that the alleged uniformity of moral judgments is an assumption utterly at variance with the facts. Everything, of course, depends upon the nature of our replies, but we believe they will bear careful scrutiny. That the reader may judge of their character for himself, we subjoin two representatives of class (1):

15 (a)-(f). I think that he should have stayed with his wife under all of these circumstances, as a man's first duty is always to his wife if he has one. His love for his wife and his sorrow in seeing her dying ought to be too great at that time to allow him to have any thoughts for himself, his own advancement, or what he could do for others, even though it might have been better for the world's advancement—as in cases (d)-(f)—if he had left his wife.

184 (a). To me it seems that had this man saved himself it would have been more right than to have sacrificed himself in order to give his wife the comfort of his presence in her last moments. Even in the case (a), though he was but a clerk with average expectations, it seems to me it would have been a more moral action to save himself, since there lies before every man, however humble his circumstances and in whatever position he may be placed, an opportunity for doing good. There was this possibility before this man, and on this possibility I base my belief.*

If it should still be urged that the appearance of diversity could be cleared away were we able to penetrate into the minds of the writers, and look upon the problem in all its ramifications, just as it presented itself to them in the moment of decision, we can confine the issue to (a).

Thirteen of those who approve the choice in this case, assert that it should have been adhered to throughout under all the conditions that follow (from b to f). Of these thirteen again, ten justify their position by alleging that a man's first duty is always to his wife, the majority adding expressly that his choice ought not to have been influenced at all by considerations of the good he might have done had he left his wife to die alone. On the other hand, after throwing out all papers that resort to doubtful subsumptions, irrelevant considerations, etc., we have still thirty-two replies that condemn the choice in (a)—and of course in all the following—in language so definite that there is no mistaking the meaning. Here, then, we seem to have a solid mass of material which no further criticism could destroy, and we therefore appear to be justified in holding that the divergence with regard to this alternative, at least, is absolute and irreconcilable.

Turning now to the questions that follow we obtain precisely the same results. At one time the two contradictory views may be about equally well represented; at another, we may find a small group of dissentients confronting a compact majority. But this minority, however small, is always as firmly convinced of the soundness of its conclusions as if it were the appointed spokesman of the universal conscience, and under no circumstances have we the right to ignore its existence or to scorn its pretensions to moral insight. In what follows we have simply to take such

* Numbers 1-57 are written by women; numbers 101-195 by men.

explanations as are requisite for the interpretation of the results tabulated on page 202, and to quote typical examples of the various views expressed.

Question II was so definite that practically all of the replies to it could be counted without fear of error. Some few indeed, as will be seen by referring to the table, are not recorded. As a matter of fact the total never reaches its limit of 152. This may be due in any particular instance to one of a variety of causes, which it would be tedious to enumerate, as they can easily be imagined. In this case the total rises to 145, which is "high-water mark," as the newspapers say.

The following are representative answers:

103 (a). I think he ought to have saved the life of his child. I can give no very definite reason for it, but it seems to me it would be right.

123 (b). The man's first duty is to his child in this case, for he has [only] a secondary duty to road and passengers. [His answer in (a) was, save the train.]

179 (a). Duty should outweigh any other consideration in the man's mind. He did right in sticking to his post. It was a great sacrifice, but a noble one. (b) The question for the second man is: Shall I save one or many? The one is dependent upon him, but his loss will bring grief to only one home. The wrecking of the train is liable to bring life-long sorrow to perhaps many homes. He did right if he stood by the switch.

Another writing in a similar strain, adds: "However, not one in ten thousand would do it."

Question V again seems to offer little or no room for misinterpretation. As formulated it may indeed be "abstract"; yet, let it be given all the concrete setting imaginable, the principle at issue would still be the same. Certainly there is no mistaking the position of those we quote:

164. If he knew hundreds of people were to be swept away and drowned, without time enough to warn both of the parties, I should say it was his duty to save his wife.

129. I believe it would have been his duty to save his wife. A man is supposed to be the protector of his family first, and should rescue them unless he felt he could do *very much* more good in some other way. I do not consider that the rescue of the two other women would have done enough more good to sanction it.

158. All other things being equal, the number of lives he was able to save [determines what] is the proper impulse [to follow], and not his personal relation to the persons in danger. But I should not condemn a man for saving his wife in preference to two other women, and I doubt if any one else would condemn him. The numbers in this case are too nearly equal, though of course the fundamental principle is the same.

45. It was his duty to warn the two women, even if he had to lose his wife. Two whole families should not be made desolate to save his wife. It was plainly his duty.

Question VI assumes that the amount of good which Howard could have accomplished by continuing his work of prison reform was greater than it would have been had he devoted himself to the training of his son; how much greater, Howard himself could of course not know. It goes without saying that different persons will estimate the effects and the probabilities to be considered differently, nevertheless the contradictions to be found here are genuine, as the quotations that follow will show:

184. If John Howard felt confident that he could train his son into a moral life, I believe it was his duty to drop his work of reforming the prisoners, even if thereby it would be indefinitely postponed. I think a man's first duty to be the training of his own children.

112. To my mind Mr. Howard's duty was to carry out his prison reform work. He thereby saved many persons from becoming moral wrecks, whereas if he had given up his work he would have saved only one. The family tie is not sufficient to cause the sacrifice of many for one on that account.

With these unambiguous utterances in mind it will be found profitable to examine Martineau's attempt to account for the contradictory judgments that Howard's career has always called forth. (See "Types of Ethical Theory," Vol. II, p. 62).

If the answers to IX are to be conclusive, one condition must be taken for granted which is not expressly mentioned in the text, namely, that, as one student puts it, "the Spiritualist belongs to the harmless type" and is therefore not likely to injure anyone else by what are here assumed to be his superstitious beliefs. An explicit statement of this condition was not demanded. It will be either stated (as it is by many) or assumed by all those who do not consider it a duty to deprive him of his faith. The only ambiguity will be in the answers of those who contend that all error must be killed regardless of consequences. In this class there is but a single paper that certainly meets all the conditions required, though at least two others offer every appearance of being conceived in the same spirit. But the outcome would have been the same had this position been entirely unrepresented on our list, for it has elsewhere found a champion who, in definiteness of statement, leaves nothing to be desired, while his rare attainments and disciplined judgment insure us equally against hasty and ill-considered expressions of opinion and against utterances that are the outcome of mere narrow-minded bigotry or provincialism. We refer to the brilliant author of the "History of Rationalism in Europe." His view may profitably be compared with that of the majority of our students.

122 (a). It would be my duty to warn him in case (a), as happiness is a minor thing compared with the possession of truth. There is a happiness in drifting and sometimes an unhappiness in struggling against the current, but drifting is wrong. (b) If I thought it would permanently injure his character, I should not speak to him, but I should not think it was wrong [to do so] if there was merely danger of unsettling it with a future chance of helping.*

49 (a) and (b). I should consider it wrong to do so in either case. Nothing would be gained, and harm would be done.

52 (a) and (b). If undeeceiving my Spiritualistic friend is going to make him unhappy and morally weak, I should consider it wrong to do so. What is the use of any belief unless it brings happiness and moral strength? What have you got if you permanently take these away?

131 (a). While I do not consider happiness the ultimate end of man, yet I believe that to wantonly make a person unhappy is unjustifiable unless more vital issues than this case supposes are involved.

Mr. Lecky: Superstitions appeal to our hopes as well as our fears. They often meet and gratify the inmost longings of the heart. They supply conceptions on which the imagination most fondly dwells. They sometimes even impart a new sanction to moral truths. . . . The possibility of often adding to the happiness of men by diffusing abroad, or at least sustaining pleasing falsehoods, and the suffering that must commonly result from their dissolution, can hardly reasonably be denied. There is one, and but one, adequate reason that can always justify men in critically reviewing what they have been taught. It is the conviction that opinions should not be regarded as mere mental luxuries, that truth should be deemed an end distinct from and superior to utility, and that it is a moral duty to pursue it, whether it leads to pleasure or whether it leads to pain.**

Question IV was selected with a view to discovering the attitude of common sense toward the dictum of Martineau that fear is higher than love of money. In attempting to make such a test we must not for a moment be supposed to

* There is no advocate of the programme, Truth at *any* cost, whose statements are definite enough to be worth printing.

** "History of European Morals," Vol. I, pp. 52-54. Lecky's attitude toward his own opinion is somewhat difficult to determine. From page 50 it appears that this judgment is conceived to be a plain deliverance of the universal moral consciousness. "The considerations I have adduced will, I think, be sufficient to show that the utilitarian principle, if pushed to its full logical consequences, would be by no means as accordant with ordinary moral notions as is sometimes alleged; that it would, on the contrary, lead to conclusions utterly and outrageously repugnant to the moral feelings it is intended to explain. I will . . . [advert] to two great fields in which, as I believe, it would prove especially revolutionary. . . . [One] sphere is that of speculative truth," etc. And yet on page 54, note 2, he writes: "The opposite view" (to that of his own) "in England is continually expressed in the saying, 'You should never pull down an opinion until you have something to put in its place.'" Perhaps his object here is merely to point out the incompatibility of this maxim with what he supposes to be the ethical axiom of the supreme obligation of devotion to truth.

assent to the proposition that either love of money or fear, abstractly considered, can have any definite position in the moral scale. Nevertheless it seemed at once possible and profitable to collect and compare judgments upon the relative position of fear in a concrete case with the desire on the part of a child for a definite sum of money whose employment could easily be imagined. As in I, the answers must be divided in two classes, (1): those that revealed unmistakably a recognition of the fact that the conflict lay between the fear of the dark and the desire for the money; and (2) those which, while apparently based on this conception of the problem, did not contain an explicit statement to that effect. All papers were excluded that based their condemnation of the child for taking the money, upon the possible injury that might result from the shock to his nervous system. Of those who asserted that no moral question was involved, some added that they should admire the child more if he refused the money; this declaration was, however, as always, offset by a contrary one, a certain number preferring to see the desire for the money get the better of his fear. The following quotations are taken from class (1):

154. "I think that the child would do wrong to go, as the motive is a low one, and the timidity should be overcome without bribery."

104. "If the desire for the money is a stronger motive than the fear of the dark, the child had a perfect right to go."

138. "The child's action is *morally* indifferent. I should think better of him if he let his desire for the money overcome his fear."

It will be observed that the returns from questions III, VII, VIII and X have been given no place in the tabulated reports. The reason is that they do not admit of a yes and no classification, as the questions themselves do not pretend to enumerate every one of the relevant considerations that might properly enter into a decision, and what is more important, admit of being looked at from more than one point of view. The significance of this latter fact will be brought out in another place. At present we shall confine ourselves to showing the existence of contradictory opinions here just as in everything that has preceded.

Number III raises the question whether the impulse to resent a certain injury is higher than the prosaic but indispensable desire to earn a living. It is not claimed that all the conditions are named which might properly enter into the consideration of these alternatives. Nevertheless it is believed that a comparison of the following opinions will not be without value:

168. The moral obligation is but slight, for teachers are so easily found, that his refusing to teach would hurt his employer little, if any, and would practically amount to biting off his own nose to spite his face. What there is, however, is on the side of his staying away. He should, if possible, refuse to teach on account of the harmful effect on his moral stamina of feeling for a year that he had bowed the knee to trickery and imposition. In (a) he should go; (d), he should stay; (b) and (c), doubtful.

56 (a) and (b). His duty is to refuse the position and trust to fortune; his self-respect demands that much. (c) Swallow his pride and accept the place. A man with a wife to support should run no risks. (d) Same as (c).

122. In all cases but (d) he should refuse the position. He owes a great deal to himself, to his manhood and independence. Except in (d) there is a moral obligation. However, case (b) is doubtful.

Some go so far as to claim that he should refuse the position in every case, one person maintaining that in (c) and (d) his duty to do so was not in the least affected by whether his wife consented to this course or not. Let us now turn to the other side.

50 (a)-(d). I think that under all the circumstances mentioned the young man ought to have accepted the salary of \$600. Although it would be very humiliating for him to do so, rather than run the risk of remaining idle, he ought to pocket his pride and accept the principal's offer.

191 (a) and (b). Do not appear to me to be cases of morals, but of ordinary sense. (a) If by waiting he could get a better position in the future, he had better spend his capital and wait. (b) Better go to work at a low salary, although tricked, than starve — pride does not furnish a substantial repast.*

Question VII deals with Prospero and his transfer of the government to his brother.

26. Morally praiseworthy, as self-culture, and the training of one's powers to their highest is one of our greatest and chiefest duties. These are among the highest ends in life.

161. Taking moral to mean the preferring of the higher and finer to the lower, I should say he did right; yet it strikes me that there is little moral quality in the choice.

167. Morally indifferent. No one other than Prospero is either prejudiced or benefited by his action.

43. The action was blameworthy if he was pursuing his studies simply for his own selfish pleasure. One hasn't the right to live simply to gain knowledge and culture for one's own enjoyment.

VIII is a problem which we are told the younger Pitt was called upon to face. What will be the attitude of common sense toward his choice? Was his ambition to become the first commoner of England higher in moral worth than the love that prompted to marriage, or was it lower, or finally,

*Additional examples will be found in the appendix.

was he at liberty to do as he pleased? The majority, represented by ninety-one papers, declare for the last. Of this number sixteen inform us that they admire him more for preferring ambition to love; forty-four would think better of him had he given up his dream of fame and power in order to marry; seven feel no preference, and twenty-four express no opinion. Eighteen others declare that one of the motives as such stands on a higher moral plane than its competitor and an obligation therefore exists to choose it. All but one assign this position to affection. The answers not enumerated here will be accounted for later. The quotations which follow will illustrate the various types:

35. I consider Pitt's decision *morally* praiseworthy, if he was thoroughly convinced the lady would hinder his life work; for ambition should stand higher in our estimation than love.

28. I believe that love should come before ambition always, and think less of Pitt, as I do of Goethe and his Faust, for choosing the latter. A man who followed his ambition rather than his love, one has an instant dislike for. I can not understand such a man. Why love should take the lead of ambition I can not explain, simply that it is so. The "should" means moral duty. [With this we may compare 2: It stunted his character to put ambition before love.]

53. It was merely a struggle between love and ambition. I consider no moral question involved. I should think the better of him for choosing the former alternative, other things being equal.

188. I can't see any moral question. I should think better of him for following ambition.

37. No moral question involved, as the young lady knew nothing of his affection, and, so far as we know, had no thought of him as a suitor. Seeing his ambition outweighed his love for the lady, he was perfectly free to lead a life of "single blessedness." In this case I think one decision as good as the other.

The young man who is offered a position in business just as he is about to enter college (X) finds the desire for wealth coming into competition with the attractions of culture. In the answers that follow, interest in the problems or the activities of business life for their own sake (there would be little room for such problems in a business of slight culture value), and all considerations of the value to others of his money or his training and knowledge do not enter as determining factors, and the decision turns solely upon the relative claims of the two first mentioned alternatives.

Number 121 writes:

A man should so direct his work and thoughts in life as to get out of himself the *best* possible results; should not let the financial future throw his nature's future into shadow. It would be wrong to accept the position. I have been in the exact position described.

47. Not morally blameworthy if he accepts it. But I should prefer culture to wealth. I respect an intelligent business man who is

capable of getting an education from the business world, but I should think less of the man who chose wealth with no culture.

17. (a) He is not morally blameworthy if he accepts the position.
(b) I should not think less of him. In his choice he knows he can be equally happy, and probably do the world just as much good.

The results thus far reached do not tend to confirm the dogma of Kant that an erring conscience is a chimera; but, even so, we are not at the end of our evidence. Question II raised the problem whether the obligation to save the train is more binding in (*a*) than in (*b*). Of those who agree that the duty to the passengers was here supreme, sixteen express themselves with regard to this point, and, curiously enough, just half reply in the affirmative and half in the negative. To get the exact proportion, however, we should have to include among the former all those who admit the existence of doubt in the second case (indicated, as already explained, by the word "doubtful" after the answer) without giving any evidence of hesitation in the first. When these are counted, the total for the affirmative rises to fifteen.

There are several other examples of divergence of opinion that tempt us to describe them, but we shall allow ourselves space for only one more. Granted that a man's first duty is to his wife, when the choice has to be made between her safety and that of two other women, is such a duty an absolute one? Can an increase in the number of those who would thereby be sacrificed finally incline the balance the other way? Examples of both of these possible views have been given on page 208 (Nos. 164 and 129), from which it appears that again there is no unanimity of opinion. Once more we find the two parties almost evenly matched, there being ten who answer in the affirmative and eleven in the negative. The majority do not raise this question at all.

If our study has convinced us that the moral judgments of different persons are far removed from anything resembling uniformity, we may go on to inquire whether the decisions of the individual conscience will show any evidence of continued guidance by the same general principles. In other words, may we look for consistency in the "intuitions" of common sense? A study of the replies to II (*b*), V and VI, will throw some light on this subject. At bottom there are but two consistent attitudes to take with reference to these three questions; one must decide throughout in favor of either the closer relationship or the more widely diffused good. In II (*b*) and V, it is life against life; in VI (essentially), character against character. The only material difference between II and V lies in the number of

persons concerned. While this may be sufficient to clear some replies of the charge of inconsistency, it does not help those who assert that the duty of the husband would have been the same, however great the numerical discrepancy. The justification for a decision in favor of the son in VI and against the child in II (*b*) may lie either in the supposition that Howard's reform meant nothing more than clean beds once a week and apple sauce on Sunday, instead of the transformation of the English prison system from a school of vice to something approaching a direct moralizing agency. Or it may be urged that in II there was no possibility of the escape of the passengers, while in the case of Howard there was, at least, a chance that some one else would take up his work. Finally the opposite view, that the child should be saved in II (*b*), and the work of reform continued in VI may find its ground in the fact that in the former case it is at most hundreds competing with one, while in the latter we have the interests of uncounted thousands thrown into the scale. Now it has been found possible to compile a list containing all the combinations of answers that are mathematically possible in which not one inconsistency can be explained away in the above manner. The possible combinations are as follows:

	No. of representatives.	II (b).	V.	VI.
A.		r	r	r.
B.	2	r	r	w.
C.	2	r	w	w.
D.	1	r	w	r.
E.		w	w	w.
F.	2	w	w	r.
G.	4	w	r	r.
H.	4	w	r	w.

These have been obtained from 108 papers, which include the *A* and *E* answers.* Some of these combinations will appear, presumably, almost incredible, so we present a specimen of class *B*. 143: II (*b*). "I think he ought not to have turned the switch, because he was not to blame for the switch being open. (Doubtful.) V. It was his duty to save his own wife. VI. His duty lay in the work he had begun rather than in trying to reform his son, because if he did not, hundreds of lives would be ruined, and only one in the other case."

In order to assure ourselves of the existence of a contra-

* The distribution of answers here was as follows: *A*, 18; *B*, 6; *C*, 2; *D*, 1; *E*, 18; *F*, 5; *G*, 33; *H*, 25. The table gives the number of those that met the tests described in the text.

diction it was necessary, in this one case, to go beyond the text of the questionnaire. Some time after the papers had been handed in, the student who wrote the above was accordingly asked the following question: If this same alternative of the reformation of a number of prisoners and the reform of a dissipated son whose rescue imperatively demanded a removal to another town, had been presented to a prison official, whose opportunities for good were very insignificant compared with Howard's, one who, if he had remained in his present position, might have reasonably expected during the ensuing ten years to restore to a life of honorable citizenship perhaps twenty or thirty of these unfortunates, whereas the chances of the appointment of a successor who would take any interest in carrying on his work, were very slight, —in such a case should the decision be as in VI? The answer was, yes. "Would you have made this same reply, if the question had been given out originally in this form?" "Yes." "Is the principle underlying this judgment consistent with that of II (b)?" At once the admission was made that it was not. The inconsistency had quite escaped his attention, but could be explained by the fact that the thought of the helpless little child sitting upon the track, all unconscious of his fate, before the oncoming engine, had appealed very strongly to his sympathies. Paper 123 differed from 143 only by the absence of the "doubtful" after II. The supplementary question elicited the same reply. The explanation here is probably to be found in the fact that the person in question is preparing himself for "charity organization" work, and in a problem involving the obligation of philanthropy, the claims of the many appeal to his sympathies. With these two unambiguous statements in our possession, it did not seem necessary to continue the investigation to include the remaining four members of the group. No. 181, one of the two representatives of class C, on being interrogated, admitted the existence of inconsistency, with the same frankness as did 143. He professed himself quite unable to explain it, however, and could only say, "Each answer represents the way I felt in regard to that particular question."

D has but a single representative. His contradictions can be explained (whether they can be justified is another matter) by his own statement of principles prefixed to the paper handed in, and first conceived and formulated (as was learned later) on this occasion: "It is the first duty of every man to see to it that he leaves a family (children) behind him, and that they be trained and educated so that

they will become honorable and useful members of society." No other claims may take precedence of this. It would appear, however, that the supreme obligation has been met when a single child has been brought to maturity. II (a) and (b). "If the man had no other sons, or if the conditions were such that the probabilities of furthering my principle were very meagre, I think he would be morally justified in saving his son and wrecking the train; otherwise not." This law, in its absolute form at least, extends only to one's offspring; between husband and wife it does not apply. Therefore unless his fundamental principle is affected, "the man should save the two women." That "Howard's duty is to quit" is the only possible position that he could take with regard to VI.

Class F. At the risk of tediousness we quote 43:

II (b). I think even in this case the man should have turned the switch first of all. He certainly owed a duty to his son, but that duty did not extend to saving his son's physical life at the expense of many other lives. The son would not have been killed through his father's neglect, but there would simply have been another duty that stood in the father's way, preventing him from saving his son. I have thought very much about this question in connection with the sixth. It seems to me that the two cases are much alike, and yet I arrive at different conclusions regarding them. It is very hard for me to make clear why I do this, and yet I feel the difference. V. I think he ought to have warned the two other women, but I don't believe any man would. Doubtful. Only doubtful in that I can not give reasons [marginal note]. VI. I have already spoken of this in connection with II (b). I think his first duty was to his son. One should not do evil that good may come, and it seems to me that he would be doing wrong to deliberately neglect his son in order that he might work even needed reforms. He was responsible for his son's existence, and so it was more his duty to see that he led a moral life than it was to work reforms for other people.

This paper is notable as one of the three (out of the total of seventy-two) that betray the slightest consciousness of the contradictions they are guilty of.

G and H do not call for special mention or extended quotation. No paper was admitted into either of these classes that was not fully as definite as 164 V (page 208) and 184 VI (page 209). Three or four did not give their opinion upon the broader problem raised by 164 until interviewed personally. The others supplied the needed information on their own initiative.

To many this entire exposition of the diversities in moral judgments will seem as much out of date as a polemic against the doctrine of the divine right of kings. It is just these whose attention we would bespeak for the method which has been used in this investigation. What we need to-day is a sense of the possibility—and the neces-

sity—of a systematic inductive study of the nature and extent of the divergencies in moral judgment among the members of the society in which we live, in order to supply us with material on which to build up a theory of the causes of such divergencies, this to pave the way or to form an element in a comprehensive theory of the conditions of moral judgment in general. The notion that such a theory already exists is an illusion. What we do find is a number of warring “types,” each of which owes its existence to the fact that it formulates in a more or less superficial fashion such portions of the moralist’s personal ideals as have happened to attract his particular attention. Those whose views are given out as a “synthesis” of “rigorism” and “hedonism” seem to imagine themselves raised above the narrowness and pettiness of the hitherto prevailing sectarianism. But without disparagement to their services to ethics, it must be said that the trail of the personal equation is over all they have written, and like those who have gone before them they have simply attached themselves to that which was congenial to their own temperament, leaving neglected much that must find a place in the completed whole. It is indeed true enough that the collection of data can never take the place of the work of interpretation, but what we need to insist upon now is that the second can never be completed till the range of the first be extended far, far beyond its present limits. One of the (we hope) many methods by which this may be done we are endeavoring to exhibit.

The next subject of inquiry shall be the alleged immediacy of moral judgments. The students were requested to indicate after each answer the length of time required to reach a decision. Unfortunately many neglected to do so, but a sufficient number sent in replies to supply data for some provisional generalizations. The first point to be noted is that the type described by Martineau and to which he evidently belongs, is so far represented as to establish firmly the fact of its existence. Five of the writers state at the close of their papers that they decided “at once” or “almost immediately” upon first reading the questions. Two others spent less than a minute a piece on each problem. This group of seven may from this point of view at least be looked upon as our “intuitionists.” Whether they satisfy other requirements will appear later. Six of them are men, a proportion which, if it should turn out to be something more than an accident due to the meagre nature of the returns, would require a modification of some popular notions. It should be stated that, in addition to

these, ten—seven of whom are men—report an instant decision of a majority of the questions. The other extreme is equally well represented. Nine students report periods spent upon one, two or three questions ranging from one to three days. What this may mean appears from the statement of 167 I: "I thought about this question a day and a half; should estimate an hour and a half spent on all phases of it." Three persons experienced this difficulty with a single question; two, with two; three, with three, and one with four. The problems that caused the delay were, with four scattered exceptions, I (in the main I (*a*)), six persons; II (*b*), five persons; V, two persons, and VI, three persons. In most of these, lengthened meditation would hardly have been possible in real life! Two others report spending "a long time" on one question, and of VI, 25 writes: "I do not know." This question, one of like import, has often occurred to me before, but I have never been able to answer it satisfactorily to myself." Of the eleven who finally found an answer after their attack of hesitation, six were young women. Between these two extremes are ranged the great majority, averaging about an hour in aggregate time, though what proportion of this was required in order to reach their decision, and how much of it was devoted to subsequent reflection, it is impossible to tell. Still it must be admitted that if Martineau's account of the process were of universal validity, no such reflection would be necessary, at least in most of these problems.* Frequently the aggregate rises as high as three hours; only in a few instances does it fall below half an hour, except, of course, in the group of seven first mentioned. In general the young women seem to make up their minds more slowly than the young men, but this may possibly be because they are more conscientious in the performance of their task. No valuable correlations have been discovered, partly, no doubt, because of the meagreness of the data; partly also, it would seem, because none exist. It is highly instructive, however, to observe 182 answering V after three days' deliberation in the affirmative ("He should have saved his wife"), while another decides it in the negative, "at once"; equally so, to find still a third replying in the affirmative, "as soon as read." 39 spends one day upon VI, and concludes Howard should have devoted himself to saving his son; 33 after two days decides Howard's duty lay with the prisoners. A large number of others could be found who were able to decide it in either way at a glance.

* *Vide supra* page 201.

What is true of immediacy holds of certainty; both extremes exist and must be included in the count when the census taker goes his round. The man who knows black from white is well represented; he says "of course," "it is perfectly obvious that," "without hesitation I should answer," "his choice was *decidedly* wrong," etc. For others these same problems are not so easy. Not infrequently the writer is unable to come to any decision whatever, as will be seen by consulting the first table. About two per cent. of the answers are marked "doubtful," indicating that no assurance is felt of their correctness. Not infrequently a second answer, contradicting the first and intended to correct it, is written in with lead pencil, or placed in the margin; or the change of heart may be indicated as follows: 160. "He should have saved his wife. On first thought it seemed to me that the man should have saved the two women, as less suffering would be caused by the death of the wife than by that of the other two; but I finally came to the conclusion that the man was under certain obligations to save his wife which would outweigh the demands that the others made upon him." Five such conversions are admitted, one each for questions I (d) (e) (f), V and IX and two for II (b). Finally one student confesses having torn up his first paper in dissatisfaction, and having started again from the beginning. For the most part doubts and difficulties are confined for a single person to one or two of the ten main problems. In seven instances, however, the total rises to three or more. The record is as follows: 35 is unable to answer III (b) (c) (d) and is doubtful about V; 44 is doubtful about I, II and VI; 45 about VI, VII, VIII and X (2); 21, about II (b), III (c) and (d), IX (2) and X; 125, about I (a) (d)-(f), II, V, VI; and 145, about I, V, VIII and IX. 111, who is doubtful about I (c), II (a) and (b) and X, writes in conclusion: "I am not yet quite satisfied with some of my answers," and 125 closes his paper in a similar strain. Thus we find the same contrasts reappearing that we met with in dealing with the time relations.

An attempt to correlate, either certainty or doubt, with the nature of the opinions stated, showed plainly that there was no fixed principle of connection. It is possible that a survey of a wider field might lead to a different conclusion, but a study of the 1500 answers before us leads to no definite results. A close relation between immediacy and certainty on the one hand, between hesitation and ultimate uncertainty on the other, is far more probable. But what with the pov-

erty of the data at our disposal it can not be demonstrated. Nevertheless such facts as these are point in that direction.

We are now free to turn our attention to the controversy between Martineau and Sidgwick with regard to the object of moral judgments. Is conduct invariably judged right or wrong because of its perceived relation to the welfare of those who will be affected by it? Or is it approved or condemned directly at a glance according to the intrinsic worth or nobility of the motives by which it has been determined? Fitly to conduct this discussion we should have to inquire into the exact nature of "moral worth," as Martineau conceives it. Is it a name for that element, or those elements of character which call forth direct admiration, for that which Plato and Aristotle held aloft under the name of the beautiful, and which he of the "pasteboard" and "the battered hack" had in mind when he said: "Observe, Sancho, that there are two kinds of beauty, the beauty of the body and that of the soul?" To answer this question properly we should have to go far afield, for Martineau's statements on this subject are by no means coherent, the obscurity being due, in our opinion, mainly to a confusion on his part between two different questions: "What is the quality that gives virtue its value? and, What is the ground of that obligation to pursue it which is held to exist quite apart from its attractiveness to any individual mind? We are invariably informed that the latter is to be found in the will of God, and sometimes this seems to be looked upon as the source of its value also. But here a difficulty arises. On the one hand the idea of obligation can not be divorced from that of value, on the other, the value of conduct will never be placed by a man with a keen sense for realities in its mere conformity to the fiat of Omnipotence. Martineau has never succeeded in discovering the clue out of this labyrinth, hence contradiction in statement and confusion of thought. On the whole, balancing his explicit denial of the identity between moral worth and beauty of character* (where the reasoning is plainly fallacious) against the almost equally explicit affirmation of a later passage,** and attributing the

* "If I follow impulse A, instead of B, my volition will be 'higher,'—in what scale? . . . Of beauty? Not so, for I have no such feeling for my pug nose, though I wish it were straight."—"Types of Ethical Theory," Vol. II, p. 46.

** "It will probably appear to many of my readers that these two concessions—that we have the power of recognizing a distinction of kind in our pleasures, and that we have a perception of beauty in our actions—make the difference between Mr. Mill and intuitive moralists not very much more than verbal!" Quoted from Lecky, *ibid.*, p. 330.

statement of the preceding paragraph* to the failure above noted to distinguish in the proper way between the grounds of value (the grounds on which God's own preferences may be supposed to rest), and the grounds of obligation,—on the whole we may affirm confidently that the actual phenomena our author has in view throughout are those to which the "inward eye" responds in much the same way as do sense and intellect to the daisy by the river's brim, or the starry heavens above us. At all events, apart from doubtful points of interpretation, both attitudes, the utilitarian and the aesthetic, may be taken towards the facts of the world of matter and of consciousness, and we may accordingly ask whether they appear as determining factors in our judgments of right and wrong.

A study of the replies to questions I, III, IV, VII, VIII and X will supply us with material which may aid us to a conclusion that shall be something more than a mere affirmation of personal preferences. It will show that Martineau and Sidgwick are both right in what they affirm, wrong in what they deny; that some value conduct primarily for what it brings, others, for what it reveals. In consequence the conditions of approbation appear to be not simple, as each supposes, but complex. One class of persons applies habitually one standard, a second another, while still a third, not the least numerous, alternate in the use of each, employing now one, now another, or both concurrently. The relations of these two types of moral judgment to each other, the question whether one can exist in entire independence of the other, the question whether there are other types besides these, and the exposition of the conditions which give rise to these diverse and seemingly contradictory attitudes—these are problems of the highest importance and interest. We shall confine ourselves, however, to the mere exposition of the facts themselves. This self-imposed limitation must excuse any apparent abstractness in our presentation of the two types of the approving judgment, whose existence we shall attempt to demonstrate; as if we attributed one "faculty" to one set of persons which we denied to another. It is always true that if a correct view of the facts themselves is to be obtained, mere descrip-

* "When the sense of beauty spreads from the sensible world to that of character, it goes only where the good has gone before it. . . . Character is not admired till it is there; and it is there, by the self-knowledge and self-assertion of ethical differences. Its rightness is not conditional on its beauty; but its beauty on its rightness." *Ibid.*, p. 329.

tion must be supplemented by explanation. But this would require a separate paper.

In the citation to replies to I, on page 207, we confined ourselves to such as looked at the problem solely as one involving a conflict of interests; the difference in the decisions rendered simply registering divergent views as to the priority of one claim which was in conflict with another. But there are persons with whom considerations of this nature, though not of necessity completely absent, retreat into the background, and the judgment is confessedly dictated by admiration for the personal qualities—that is to say, the springs of action—conceived to be displayed. As representative of such an attitude we may quote the following:

127. Such heroic conduct is indeed worthy of admiration under any circumstances. This is carrying out the marriage vow to love, cherish and protect to an extreme and certainly far beyond the point where failure to act could be justly criticised. Most mothers would be proud to know they had such a son, and that thought would be likely to comfort his mother in her old age. Leaving out the emotional side an invalid is no help to society, and if his life served merely to prolong her existence, the benefit might fairly be questioned. [(d)-(f).] Some one would probably come forward to take his place.]

180 (a). It would seem to me in this case he showed a devotion to his wife which was commendable and heroic. To be sure, his purpose might have been thwarted, inasmuch as his wife's pain would be increased at the sight of her husband's sufferings. But he had no time to weigh all this, and I think that under such circumstances he showed a strong and brave character.

56 (a). He did nobly. A man would be a coward who would save himself and leave his wife to perish alone when he had no one else to think of. (b) He certainly ought not to bring grief to his mother when he could possibly spare her. This [entire] question troubles me greatly. Such a death is equivalent to suicide, and of course from a moral point of view that is wrong under any circumstances. But, right or wrong, if I were his mother, I'm sure I should rather he did not desert his wife. (c) I fear it is his duty to live in this case, but I am sure his conscience would trouble him ever after for leaving his wife. However, I may not be looking at this question rightly, but it seems much more heroic unselfishly to die with his wife rather than to live when she could not (as far as comforting her last moments is concerned, it would be more of a comfort to her to know that he was safe; and she could die as bravely alone, I hope). I find I can't answer this question at all. My intellect seems to tell me it is his duty to live; he has a duty to perform on earth which no one else can do. (d) I don't think one clergyman more or less would make any difference, and he ought to stay with his wife. (e) Better to stay with his wife; the electric telegraph would have been invented sooner or later anyway. (f) Stay with his wife. In this case he has no duty to perform, and the good he might do to the world as an artist is very vague. I am not satisfied at all with these answers. I think, if the question of suicide did not arise continually in my mind, they would satisfy me.

The last quotation is extraordinarily clear and definite because her position is taken in direct defiance to all utilitarian considerations. His presence at his wife's side would have done no good of any kind, because "it would have been more of a comfort to her to know that he was safe;" nevertheless it was heroic to remain, and for this reason he should have done so, regardless of his mother, of society at large, and perhaps even of the dependent invalid. At the same time the intensity of her feeling is shown by the evidently painful character of the running fight carried on between her direct approvals and the protests called forth by her submission of the action under suicide.

Of our 152 papers, nineteen answer the question in this spirit and from this point of view, at least in (*a*), and some of them throughout. Six or eight more might perhaps find a place in this list, but their statements are not full or definite enough to classify with any degree of certainty. Twenty condemn the act as suicide. For the remainder it is simply a question as to which of two parties may justly claim the man's services—of where he could do the most good, or whether the close relationship between husband and wife justifies him in choosing to support and comfort her during a few brief moments at the cost of sorrow or privation to another, or of some loss to society at large.

Of the answers to III, fourteen are certainly judgments of admiration; twenty-two are too brief or too ambiguous to be classified; the rest are utilitarian, claiming either that no moral question was involved, at least in (*a*) and (*b*), and sometimes throughout, or asserting that he should have refused the position because of the danger in permitting trickery to succeed, or putting forward some reason which consisted in a reference to the effects of his action upon the welfare of some of those concerned, or society at large. Of course, some of those who answer, "No moral question involved," may have failed to express a preference for one spring of action over the other only because they failed to notice this aspect of the case. But, if so, we may infer that they were not in the habit of settling moral problems by looking for the competing motives and noting their relative rank, as Martineau claims is habitually done. So that while our figures would probably have varied slightly if we had analyzed our problems and exhibited for our students all their bearings, yet the results in so far as they were different would undoubtedly have given a far less correct notion of every-day modes of moral judgment. Examples of the two varieties of answers have been given on page 212, and

additional ones will be found in the appendix. In what follows, all examples will be found under the discussion of variations in moral judgment, and in the four papers which are quoted entire at the close of this article.

In IV there are thirty-three answers (class 1 in the first table) that explicitly recognize the existence of a conflict between two motives, desire for the money offered, and fear of the dark. Only sixteen of these hold that he does wrong to give way to his desire for the money—that he chooses the lower motive thereby, and if we add to this number all those who are counted in class 2, we have at most twenty-five. Five others think that he ought to go, but give no reasons. A number condemn him for going because of the injury he may do himself by the nervous shock,—these do not appear in the table at all. The rest content themselves with asserting that there is no moral obligation one way or the other, the few who volunteer any explanation adding, "because he didn't do himself or anyone else any harm."

The answers to VII must be divided into four groups. (1) contains the ambiguous ones—"Prospero's choice was praiseworthy," or the reverse. Here are to be found twenty-four papers, all but one of which approve of his actual choice. (2) Culture is declared to be an intrinsically higher or nobler pursuit than power—judgments of the form that Martineau's theory requires. Two of the total of eight are cited on page 212, and two on 231 and 232. (3) Seventy-seven judgments are rendered from a purely utilitarian standpoint; *v. references* as above. (4) The answer is simply: "No moral question involved." Even after making all possible allowances for obtuseness of vision these judgments seem as directly incompatible with Martineau's theory as those of (3). In fact, in the great majority of cases it is undoubtedly the same position, stated without explanation of the grounds on which the decision is made.

An examination of the replies to VIII leads to similar results. Martineau's attitude is represented by nineteen papers. There is not, however, complete agreement as to which spring of action is to be assigned the higher rank, seventeen deciding in favor of affection, one for ambition, while in one the writer declares himself unable to choose. But even in this small number we find eleven introducing utilitarian considerations, as does 194, for instance (*v. appendix*), leaving but eight in which the attention is directed solely to the intrinsic worth of the motives themselves, without any thought of other considerations. Eleven others condemn the choice of ambition without assigning their reason, and five more make the same reply with the understand-

ing that Pitt's motives were purely selfish. Still another group, again numbering eleven, hold that an obligation exists in favor of one course, but do not appear to find its ground in the relative rank of the contending motives; the considerations adduced are, in the main, the obligation due to himself to marry in such a way as will best conduce to his own happiness, or the duty of considering the lady's happiness, provided that he really loves her, or the duty he is alleged to owe himself to rise in fame and power as high as his abilities will carry him. Ninety-one consider no moral question to be involved—he is free to do as he pleases. About half of them assign no reason for their conclusion; the remainder fall into several groups, according to the nature of the conditions under which alone their decision is stated to hold good; of these the principal ones are that the young lady's feelings are not to be taken into account, and that Pitt was to no appreciable degree moved in his choice by a desire to be useful to his country.

The same types recur in X. Those whose judgments are clearly based upon a comparison of the intrinsic excellence of the competing motives here number twenty-seven, of whom six fortify their conclusion by the claim that a man of education can be of more value to the world than a man of wealth. Fifteen others cannot be classified; some of them may perhaps belong to the first group. Two find it impossible to make up their minds whether any obligation exists in favor of either one of the alternatives or not. Twenty-five judgments are plainly representatives of the pure utilitarian standpoint. Finally seventy-six assert that no moral obligation exists to choose one course rather than the other. The question, "Would you think better of a man for choosing one or the other of these alternatives?" forces everyone to face the problem of the relative excellence of culture and wealth as ends of action, so that members of this group have practically placed themselves outside the pale of Martineau's theory. With regard to this last question, forty-five would think better of him for choosing the college education, twenty-one would think neither more nor less of him for so doing, and ten do not reply. For example *v.* page 213 and appendix.

Of the four remaining questions little need be said. Express or implied references to the relative rank of motives do not appear except in isolated instances. In II (b) the majority of 109 argue, except in two or three cases, after the manner of 179, the minority like 123 (page 208). Answers such as that of 16 (page 231), stand as solitary as Heine's fir tree. And yet if throughout attention has been directed immedi-

ately upon the quality of the motives, we cannot but wonder that the fact does not appear in the language employed. The same results appear in V, VI and IX. The decision in V and VI seems always to turn on the place where the superior obligation to service lay; of course, this may be *interpreted* as equivalent to asking whether conjugal or parental affection is higher than compassion for several or for many; on the other hand there is no evidence that the problem presented itself in this form to the minds of the writers. Again in IX the majority who, it will be remembered, subscribe to Gray's well-known creed, mention no other consideration than the happiness or the character at stake, while in the ranks of the minority appears no one who writes on his banner: The impulse to make others sharers in our own views of truth is higher than a regard for their happiness. The nearest approach to such a formula has been given on page 210.

If the evidence adduced has been sufficient to establish as a fact the application of these two criteria—the aesthetic and the utilitarian—to the solution of moral problems, it only remains to inquire whether the causes, whatever they may be, that produce either of the two corresponding attitudes are operative in the same persons under all circumstances; whether, in other words, there is a type of mind for which Martineau's description holds without exception and another which stands in a similar relation to Sidgwick's theory. Beginning with the latter, we may propose a looser and a more severe test. If we count as utilitarians those who appeal explicitly and exclusively to the effects of the action under consideration upon the happiness of the agent, or other individuals, or the welfare of society at large, in one or more of the following questions, viz.: I (*a*), III (*a*), IV, VII, VIII, X, and who, furthermore, nowhere introduce any references to the qualities of springs of action or the relative superiority of one over the other, we shall have a group with sixty-seven members. On the other hand we may adopt a criterion which seems to exclude the possibility of any mistake. We may count only those who in every one of these six questions either make a direct and unambiguous appeal to utilitarian considerations, and to these alone*, or who, while recognizing in any given case the existence of a conflict between two impulses, assert that there is no obligation to choose either one or the other (for example, *v.* papers 53 and

*This is interpreted so as to exclude from the group those who in I (*a*) condemn the action of the clerk as suicide.

37, p. 213.) This second condition was introduced primarily to cover a single answer in one paper, 191, which beyond all doubt belongs to this group. It will be referred to again on page 231. As a result of this sifting process we have nine papers of whose attitude there can be no possible doubt; in fact, they read as if written to serve as illustrations for the "Methods of Ethics." In the appendix two of them will be found quoted in full; they were selected as representing very well what may be roughly distinguished as the philosophic and the common sense types of utilitarianism respectively. Positive assurance can be given that neither the writers of these nor of the other two papers quoted in the same place, had ever made any study or ever done any reading in the field of systematic or applied ethics or of philosophy in general, or had picked up ideas or theories from other students who had done so. Their views, and the language in which these were expressed, were purely their own, with the exception, of course, of the ever popular "greatest good to the greatest number," which, it appears, was picked up in the university debating societies, where it has long been a favorite weapon.

Turning now to the use made of the aesthetic criterion, we should expect to meet with a similar showing. Quite the reverse, however, is true. Its appearance at intervals is indubitable, but with rare exceptions, its employment is sporadic, confined, in the main—as our evidence goes to show—to one or two problems. Not only do considerations conceived in this spirit fail to appear, with an occasional exception, in II, V, VI and IX, but there is no one example of its use in all the remaining six questions. No. 194, whose paper is given in full on page 232, is alone in exhibiting the presence of this point of view in as many as five answers; but on the other hand, the union of the aesthetic and the utilitarian standpoint is particularly marked in him. Four others decide four questions on grounds of admiration for springs of action; four more decide three in the same manner; thirteen others, two, and forty-six, one; making a total of sixty-eight who show some trace of the use of the "aesthetic method of ethics."* Of these there are but four who in every case keep themselves entirely "unspotted" from utilitarianism, as that was defined in making up the second group of nine (page 227). The exclusion of those who, while distinctly recognizing the fact of a conflict between certain

* We have seventeen papers left that are still unaccounted for. They gave no reasons for their replies in any instance and their position is therefore impossible to determine.

motives, refuse to adjudge one higher than the other may on first thought seem arbitrary, but we have Martineau's own statement (and it is in the main his doctrines that we are testing) that whenever two impulses come into competition, one of them is immediately recognized as the higher. Moreover, the application of this test excludes but six at the most. One of these is 16, the propriety of whose rejection (on the ground of her answer to III) may perhaps be questioned. If this is allowed to stand we have but one member of this small group of four who answers as many as three questions from the aesthetic point of view. The other three are included on account of their answer to a single question ; as outside of this they vouchsafe no reasons for their conclusions whatever, their presence in this group may perhaps be merely due to their preference of golden silence over silver speech. In the appendix will be found paper 16, which, everything considered, comes nearer to representing the type of mind described by Martineau than any other in our possession. 194 is of interest as an example of the fusion of the two modes of judging. The following table exhibits the nature of the answers to our six test questions of the nine leading representatives of the aesthetic attitude. *a* indicates that the answer was based on grounds such as Martineau would lead us to expect to find ; *u* is utilitarian in the sense defined on page 227 ; a dash indicates that the answer was rejected on account of ambiguity, or for some of the other reasons referred to in the earlier part of this article ; a question mark, that the writer gives no reasons by which his attitude can be determined ; *u* with a question mark, that the writer, without explicitly mentioning the two competing impulses and without stating the grounds for his opinion, affirms that no moral problem is involved. *S* in I means that suicide was assigned as the ground for condemnation.

No.	I (a)	III (a)	IV	VII	VIII	X
11	a	-	?	a	a	u (?)
16	s	u	a	a	a	a
26	a	u	u	a	a	{ a u }
35	u	a	?	a	a	a
39	u	a	a	u	u	a
48	u	a	u (?)	{ a u }	a	{ a u }
127	a	a	-	u	u	a
141	?	a	a	u	a	u
194	u	a	a	a	{ a u }	a

Should a broader induction confirm the results here obtained, we should have to admit the existence of at least

two "methods of ethics" which may even dwell in the same mind side by side. Furthermore, we should be compelled to recognize the fact that on the whole the aesthetic plays a subordinate rôle in comparison with the utilitarian, and that even in those to whom it means most it may disappear at times before the pressure of the demands of the "utilities." How impossible it is for the mind to so far abstract from the felicific consequences of conduct as to deny them any share in the formulation of moral judgments, is well shown by the following remark of Martineau, incidentally dropped in the discussion of other matters: "By importing a distinction of finer or more vulgar into human satisfactions, you do not step into the region of morals, but only change the field of extra-moral good. . . . All that you can say to any one [who prefers the coarser to the more refined] is, ' You do not make the best of the resources of your nature:' and he may answer, ' Perhaps not; but I am the only sufferer by the waste, and am therefore a squanderer only, and not an offender; I wrong no one but myself; and am simply a poorer economist.' " * The note here struck is entirely out of harmony with all else that he has written, but it reveals the existence of forces which, ignore them as he may in his hours of speculation, undoubtedly play an important part in his every-day judgments of right and wrong. Not that Martineau has entirely ignored the existence of a "canon of consequences;" no one could possibly do that.** But he has failed to recognize the importance of the part it plays in the life of men, and he has not succeeded in assigning to it its proper place in the constitution of the human mind, nor, as a result, in defining properly its relation to those forms of judgments with which he is most familiar. Similarly, the utilitarians, while to-day commonly admitting the existence of beauty of character as a fact, have never seriously investigated the nature and the extent of its influence in determining the attitude of men towards the concrete problems of the morality of given lines of conduct.

It has been impossible to establish the existence of any definite relations between the employment of one or the other of these methods and the time required to form a decision, and the certainty with which its affirmation is accompanied. The nine papers whose answers are tabulated on previous page do not differ materially in either of these respects from the remaining ones. Some answered at once, while others spent a day on the same question. On the whole this

* "Types of Ethical Theory," II, 109.

** Cf., for example, the statement on p. 271, beginning: "I will not say that no one ever . . . with Bentham, consulted the arithmetic of pleasures and pains, and struck their balance."

was to be expected. This type of mind will often find its way blocked by a conflict between what it admires and what it judges useful, a conflict to which a mind of the type represented by 191 or 192 is an entire stranger. Moreover, so much, at least, is known of the phenomena of "intuition" as to prove that there is nothing incompatible in it with judgments based in reality upon a great mass of data.

In concluding this study we may call attention to the possibilities thrown open by the method we have exhibited of an objective investigation into the causes of moral judgments. If the various answers given to questions such as these can be correlated with various mental traits, with the power of abstraction, the power and habitual direction of the imagination, with temperament, age, sex and environment, or if when brought face to face with his own inconsistencies, the person questioned can be led to describe the nature of the difference between his various attitudes toward a series of similar problems,—if this and much more of the same kind can be done, the foundation will have been laid for a theory of the conditions of moral judgment, which shall not be at the mercy of either the ideals or the whims of individuals or passing generations. Some fragmentary data of the kind demanded have been thrown into our way in the course of this investigation, but it has seemed advisable to withhold them because they can acquire real significance only as part of a system of facts, most of which still await the discoverer.

APPENDIX.

No. 16.

I. In any of the conditions he committed suicide. A man may rush into danger when there is hope of saving anyone—lose his life in so doing—that would be bravery. In this case escape of his wife was impossible—he knew it—and by remaining there he deliberately took his own life.

II. (a). He must turn the switch and save the passengers. (b) To save his child would be the natural and instinctive action, but to save the train would be a higher, more sublime choice. Morally he would be bound to save the train.

III. (a). No moral obligation one way or other.

(b). No moral obligation one way or other.

(c) If he had no chance for other employment he is morally bound to "swallow discomfiture" and accept position. (d) Morally bound to accept position.

IV. If the child accepted money he yielded to a lower motive, chose a lower alternative. He should be taught to do right for right's sake, not for money.

V. He should save his wife—he had promised sacredly to protect her. To the other women he did not owe this moral obligation.

VI. The duty of John Howard was to save his son. Parental responsibility outweighs any philanthropy.

VII. If the brother had no taste for any other employment than politics, Prospero's choice was praiseworthy. If the brother was

equally fitted [to rule], Prospero's choice was again praiseworthy, as one should, when possible, cultivate all talents with which he is endowed. He owes it to himself to do so.

VIII. To sacrifice love to ambition is to follow a lower motive. Ambition is sordid and selfish. From the moral standpoint he should accept love and fling away ambition.

IX. (a). It is decidedly *not* your duty to attempt to undeceive him in either case. The theology of the world is in too doubtful a state to attempt to say definitely how much of truth a man has.

(b) I should think it wrong in both cases.

X. If he has any one dependent upon him he is bound to accept the position, if immediate support is required. If there are no "encumbrances," if he is entirely free, the higher choice would be in favor of cultivating the mind. Wealth is a baser motive than literary attainments.

No. 194.

I (a)-(f). He would not be justified in dying with his wife. The Bible says care for the living and not for the dead. The woman in question is not dead of course, but comes within the application. It would be extremely selfish on her part to expect him to sacrifice his enjoyment of life and to expect others to forego the good he might do them. In most of these conditions great good is conceded [as accruing] to his fellow-men from him. For him to die would be a loss of the benefits of (b) (c) (d) (e) (f) to mankind. This would seem to be wrong, opposed to the express commands of Christ. Temporary comfort to the wife set over against permanent good to the world. I cannot see why (a) should be excluded either. If the clerk does some good, his life is a benefit and should be prolonged.

II (a). The man should have decided in favor of the lives of the passengers. (b) Same decision. In these cases the man was choosing between a greater and a smaller sum total of suffering. He looked [should look] upon himself and others from an objective point of view and sacrificed [sacrifice] his child on the broad principle that it was better for one man to endure, even if it was he, than that many should suffer. [The fact that he was on] duty did not make his decision more compulsory; it is not plain how a sense of duty can claim to compete at all in such a case with such a broad principle [as that just laid down] or even strengthen it.

III. I think that he is under moral obligation to reject the \$600 proposition in every case. Evidently a wrong has been committed; his own self-respect demands that he do not tamely submit to being tricked, and besides he should not be a party to the successful issue of the low scheme. Even if his wife (in c and d) had requested him to accept the position, his duty would still be as above, for there is always some way of earning a living.

IV. The child has done wrong if he goes, though the offense is light. He did for money what he ought to have done for a higher motive, namely, desire to strengthen his courage.

V. To warn the two women. Same principle as in I and II, the greatest good to the greatest number, and least sum of suffering. Warning his wife would bring more satisfaction to himself and less to others, but this would be selfish. He is supposed to look upon all as on the plane of common humanity, not as separated by artificial ties.

VI. His duty lay with the work begun. Same principle as in I, II and V. . . . Could Moody well stay home to bring up a son?

VII. The choice was praiseworthy morally because culture is a nobler aim than power. The better a man becomes himself the

better able he is to influence others to a higher life. Prospero became more noble and could bring others up to a higher level. His self-denial was itself a growth. The city was ruled as before.

VIII. Pitt's decision was unpraiseworthy morally. It was directly contrary to the principle involved in VII. He repressed love, an ennobling feeling, for selfishness, a degenerating impulse. Such selfishness persisted in might have made a spoils politician of Pitt at this day and made him less useful to his country in advocating good measures, etc., than he would have been even holding a lower position, but with higher motives.

IX. I should not consider it my duty simply on the condition of his being a Spiritualist and with results as in (a) and (b). I think it would be wrong to say anything that would bring about the results in (a) and (b). Right living and spiritual inspirations are objective things in religion, and these would not be improved by the results in (a) or (b). One would think that a Spiritualist could secure the main benefits of religion which he could not under (a) and (b)—not as well anyway. The best sum of good should here be aimed at.

X. He seems to me to be morally blameworthy. With the opportunity for either business or a college course he should choose the latter. Culture and the development of the mind are granted higher aims than money, are declared and recognized to be higher.

NO. 191.

I. A question whether deliberate suicide can or can not be called morally right. To my mind it cannot. In these cases a man, in order to give a few moments of comfort to a dying person, deliberately gives up a life which might accomplish untold good to many hundreds. He certainly could accomplish during a lifetime results of infinitely more value than the uncertain comfort or support given in this case.

II. Love and human nature *versus* duty. Doubtless he should have saved the train because by so doing he could save a greater number of lives than in the other case. However, the ties of blood are so strong that in nine cases out of ten the man would save the child. (b) The decision should be the same.

III. (a) and (b). Do not appear to me to be questions of morals, but of ordinary sense. (a) If by waiting he could get a better position in the future, he had better spend his capital and wait. (b) Better go to work at a low salary, although tricked, than to starve—pride does not furnish a substantial repast. (c) and (d) Same as (a) and (b).

IV. I think it is a question of the desire of money overcoming the fear of the dark. If any moral question is involved it seems to me to be on the side of the parents that allowed the child to grow up in fear of the dark. Then it would become a question as to the means of obtaining a desired end, whether bribery is an allowable means of obtaining this end—I think it is.

V. Question of duty to your wife or to two persons not at all connected with you; of the death of one or two persons. I presume, looking at it from the good to the world and ignoring self, one should save two lives rather than one, but the other being his wife I should say save the wife. A man owes his first duty to his family, after that to the world.

VI. Drop his work and take care of his son. There would be others who could attend to the prison reforms. No one is so all-important that his place cannot be filled.

VII. I think it may or may not be a question of morals. If he gave up political power because it was distasteful to him and

science was pleasant, he cannot be either praised or blamed, as it was simply a question of natural tendencies and of what was pleasant to self. On the other hand if both were equally pleasant and he carefully weighed the amount of good which each would accomplish for mankind and found that in his opinion science and culture would do the most, and chose the latter, I should say his choice was praiseworthy.

VIII. Does not seem to be a case of morals, but of self-gratification, the amount of pleasure being greater in one case than in the other, the desire for fame being greater than that for love.

IX. I should consider it wrong to do so in both cases. He is sincere and content with his belief and harming no one.

X. I think that culture could be obtained in great measure after he had reached a certain stage of his career (travel, literature, environment, etc.). At any rate if he is as fully satisfied with his life of business as he would have been with the culture obtained from his college education, and, on the other hand, if the latter would enable him to be a success in his chosen career after leaving college, I should say it was a matter of choice, either career being one of fame and honor.

No. 192.

I. In answer to question I, I would say that the man was wrong in staying with his wife in this crisis, for this reason, that it is the duty and mission of every man to do something for the good of the world; this is the object of life. In cases (b)–(f) there can be no doubt that he did wrong in sacrificing himself.

II. I think that in (b) the switchman should have saved the passengers. Reason: By abandoning the child he saved lives more valuable to the world. In case (a) he should certainly attend to his duty, because his obligation to the passengers is greater than that to the child. I believe any father in such a case would save his child, but I think his moral obligation to his fellow-men should preponderate.

III. (a) and (b). I think that it was the man's duty to accept the position because of his duty to his fellow-men. By his teaching he would benefit a portion of his fellows; by staying idle he would not. In cases (c) and (d) he was morally obliged to accept.

IV. It is the child's moral duty to himself to refuse to go into the room; by so doing he injures himself and benefits no one.

V. I think it was the duty of the man to warn the two women.

VI. Here is the duty of father to son contrasted with the duty of man to his fellow-men; it is the duty of man to do the greatest possible good, hence I think that it was Howard's duty to carry on the work of prison reform.

VII. I think that Prospero was not only justified, but that it was his duty to leave the government to his brother, because by so doing the greatest benefit to his fellow-men could be wrought.

VIII. In No. VIII I do not think that any moral question was involved. If he had led the lady to believe he was going to marry her, his action would have been wrong; but as only his own happiness was affected by his choice, he was free to do as he pleased.

IX. It would certainly be wrong in case (b) to undceive him, and also in case (a). In case (b) you would do harm to him and no good to others unless he was converting others to his belief. The same is true of case (a). If you believed that he was harming others by his belief, you would be justified.

X. It would certainly be his duty to refuse the position offered him and to attend college; by so doing he would prepare himself to bring about the greatest good.

DISCUSSION.

REMARKS ON TICKLING AND LAUGHING.

BY HIRAM M. STANLEY.

The interesting article on tickling and laughing in the October AMERICAN JOURNAL OF PSYCHOLOGY suggests some further remarks on the explanation of these phenomena, in a somewhat different order, and to remark upon some points little or not at all noticed by that article.

The question of the *rationale* of tickling involves: Why does this light contact so generally and acutely excite? Why does it issue in laughter?

As to the first question, "the strange sensitiveness to minimal tactile impressions" that "has never been explained," this is in the article explained by survival and revival of "the oldest stratum of psychic life," that is, of primitive touch experience when there was "no sense of gradual approach." The revival theory is a valuable one, but it appears to me that ticklishness implies tentacular experience. By temporary self-extensions even low amœboid organisms have slight but suggestive touch experiences that stimulate very general and violent reactions, and in higher organisms extended touch organs, as tentacle, antenna, hair, etc., become permanent and very delicately sensitive organs, where minimal contacts have very distinct and powerful reactions. Tentacular experience forms the main phase of psychic life for a considerable time in biologic history, and constitutes a psychic age which is very little understood. We come nearest to it, perhaps, when groping about in the dark in a strange place and surrounded by totally unknown objects. We are then all touch, and the slightest contact induces strong though indefinite fears and activities. This ticklishness, as agitation at minimal contact, is survival of long past ancestral tentacular experience.

But the difficulty here occurs how and why tickling should be pleasurable. It is certainly evident that the function of stimulating minimal contacts has been chiefly evolved as painful agitation, intense alarm and violent efforts at flights; and that survivals and revivals *per se* can only be the same in nature. Yet we know that tickling now causes spasms of

keenest pleasure, and hence, if it is survival, it must point to some other form than the minimal contact agitation developed in the struggle of existence. And this other form we believe to be play activity. For what is play in its simplest and earliest form but a light touching in a mimic alarming? The earliest seems to be tag; and I have seen a school of fish ("suckers") thus engaged, one fish nipping slightly and playfully the tail of another, and then swimming fast away to be chased playfully by the other. The pleasurableness of tickling, then, is in its playfulness and as reviving a vast mass of ancestral play experience. As Darwin remarks ("Expression of the Emotions," p. 201), "a young child, if tickled by a strange man, would scream from fear." That is, here the revival is toward the minimal contact experience of direct utility in the struggle of existence, rather than toward play activity.

This of course merely throws the problem further back, and we have yet to inquire as to the nature and *rationale* of play activity and its pleasurableness. All activities from the psychic side may be divided into two grand divisions: playful and serious; and it is extremely remarkable how far down in life this distinction runs. Even low microscopic organisms have seemed to some observers to give evidence of playfulness. But play is, psychologically speaking, quite complex; as shamming for its own sake it is evidently so enjoyed by almost the whole range of living beings without reference to life values, and thus seems the primary aesthetic element. Play is appearance as opposed to reality, or rather reality putting on appearance. To ascribe play to mere overflow of energy helps but little, for we must ask, why, under natural evolution, should superabundant energy be generated. Is not this directly opposed to the law of economy which prevails in all evolution under competition and the struggle of existence? But if energy becomes superabundant, it will flow out the usual channel in the usual way, and so an irascible creature will expend this energy in fighting, *i. e.*, serious activity, which, indeed, we often see. Mere superfluity of energy does not explain why the usual activity should be used, but in a playful manner, *e. g.*, not in fighting, but in playing at fighting. Mere superfluous energy leads the puppy to bite, not play at biting; that is, playfulness is purely a mental quality, for which mere amount of nervous energy cannot account.

For the psychic basis of the pleasurableness of play we may perhaps find a clue in guile. Guile and play are both assumptions of expression, but guile is earnest method in the struggle of existence in the forms of mimicry, cunning,

strategy, etc., whereas play is foolery for its own sake. Yet the pleasure in this foolery is probably derived from the exultation in successful deceit which has marked the evolution of life. Play in the primitive form is playing a trick. Play is thus feigning. One puppy feigns anger, growling, chasing, biting; and the other, feigning fear, flees. Here is mutual duplicity, and mutually understood as such, acted out for the sheer pleasure of the activity—*aesthetic action*,—and thus a most marvelously complex psychosis for low orders of life. Yet to fool and act the fool seems equally pleasant in the play of young animals; the pursuer and the fugitive both enjoy their pretence. However, we may well suppose that play was at first one-sided, and that the acting the fool is comparatively late evolution. We often observe such one-sided play. I have noticed a large dog which enjoys putting little dogs into a genuine scare and flight by a sudden great bark. The reciprocity of complete play does not enter here, nor yet in the case of a cat playing with a mouse. All teasing is one-sided play. How reciprocity came to be established is a difficult point; possibly as a mode of defense.

To account for play-pleasure by reference to pleasure of deceit, certainly covers many cases, and those the very crude ones of “horse play,” practical jokes, fooleries, and masqueradings of all kinds. It also may cover what the article calls “Laughter at the *Naïve* and *Unconscious*,” since the *naïve* means being “fresh,” “green,” “gullible.”

The relation of play to higher modes like wit and humor is apparent in that surprise and contrast underlie all three. Surprise is a method of attack which is most successful in the struggle of existence, and hence most pleasurable. So the pleasure of playing in its keenest form is that of surprise, which, when cultivated for its own sake in a purely mental way, as suggested by word and action, enters into both wit and humor. And the physiological side of surprise is shock, sudden and violent agitation. Tickling is organic surprise in that there is unexpectedness as to localization. Other senses than touch may have a sort of tickling. Thns may not the sudden popping before an infant’s eyes of some object, as in playing peek-a-boo, be a tickling of eye sensation? The ‘peek’ startles the eye, the ‘boo’ the ear, and the play-pleasure expresses itself in crowing laughter. I have observed a child of nine months express its merriment at a gurgling noise by a squeal made during inspiration. Snuff-taking is a nostril tickling.

Contrast is a fundamental element in play. All play is an apprehension of and delight in the contrast between the real and unreal. In one direction this culminates in

comedy, in the opposite in tragedy. There is a continuous evolution from the puppy mimicking anger to Jefferson personating Rip Van Winkle. The whole range of play is fictional and imaginative. Every action may be acted, every feeling and thought may be fictionally expressed. But play is most prominent on those levels of life which have been fully integrated. Thus the dog does not play in the forms of activity which men have taught him, as in drawing loads, but reverts to wolfish action. The most progressive forms of human activity are rarely used as play forms. There is more sport in hunting than in writing papers on psychology. Men play with the past, and that is where the main field for art lies. Those who interpret an age to itself do it in a sober, business-like, realistic, earnest way which is hardly play. The height of severest endeavor by which a race is at present progressing is not an inviting field for its play activity. Play is the outgrown clothes in which humanity still likes to masquerade.

Whether the laugh at injury to another may be related to play is perhaps questionable. And yet we know that getting another at a disadvantage is a prime joy in competitive existence, and is continually played at. The laughter excited in us at the sight of a man chasing his hat down the street is probably related to play activity and playful exultation over disadvantage to another. (A somewhat completer discussion of play will be found in my "*Evolutionary Psychology of Feeling*," pp. 298, 350, 364.)

But we come to the further question why the pleasurable agitation of tickling, sensuous and mental, should issue in laughter: how does the peculiar action of diaphragm, lungs and vocal organs which we term laughter, arise? and why is this reaction confined to human beings? Thus in playing hide-and-seek with a dog, when he suddenly comes upon you he will express his delight in joyful barking, while a child in like case will break into hearty laughter. Now the rise and progress of laughter in the human being is, I think, to be connected with the rise and progress of articulate expression of which it is but one mode. In fact, we may define laughter as articulate merriment. At any rate, in a very broad but real sense, the hearty laughter of a civilized human adult may be termed articulate in comparison with animal and infantile expressions. If this be a real clew we should expect that those savage tribes whose language is largely composed of clicks, will have little capacity for laughing of the European type. That is a point which is worth looking into, and the whole subject of race and language as bearing on laughter is yet to be explored in any thorough manner. The method of

laughter with the deaf and dumb should also be studied. The growth of laughter in relation to articulate expression in general in infants must also be thoroughly investigated. It seems probable that laughter is an articulate development from the shout or crow of pleasure, and sobbing likewise from the scream and howl of pain. An indication of this is that in the height of pleasure and pain, when we might expect expression to revert to primitive form, laughing often ends in shouts, and sobbing in agonized wailing. Further, Mr. W. S. Landor observed that on occasions when a European would laugh, an Ainu would be apt to shout with pleasure. Thus, laughter may be considered a reduplicated and articulated shouting. Laughter, once established as a mode of pleasure expressions, expresses tickling. However, the better position is that tickling pleasure as reminiscent of ancestral play is expressed articulately in man by laughter as the original mode, other forms being later. Again, as a cause of laughter, we may suggest that the tickling stimulates and sets up violent motor response, as in the joyous play activities of chasing and fleeing, but when this external response, as running, is not carried out, this tickling cumulates the internal response in lung actions, diaphragm, etc. Laughter is a panting. In short, the organism reacts like a "racing" engine.

It is interesting to note that the laughable does not equal the pleasurable, that laughter has not come to be expression for pleasure in general, but only for certain kinds of pleasure, and those rather slight and frivolous. The strongest and most exciting amusements, as horse-racing, football, prize-fighting, induce the keenest pleasure in skill and in the joy of success in combat and competition — under conditions of the struggle of existence this joy of successful conflict being by the very nature of evolution the greatest and deepest — and yet laughter is not found here. Laughter is essentially a minor affair and implies a certain careless objectivity as opposed to vital subjective interest. So duplicity is not laughable in matters of the highest import. Military strategy does not excite laughter, but the strategy of a negro in robbing a hen-roost may seem highly laughable. All which points to the conclusion that laughing is born of play, and is mainly and fundamentally playful throughout its whole evolution even to the latest forms of mental play.

As to the method of investigation, the *questionnaire* mode of popular reports is evidently a crude and very tentative form. This method is scarcely used by any science but psychology; biology, physics and other sciences collect their facts not from general observations sent in by the untrained or half-trained observers, but wholly by the direct studies of expert

scientific observers. A geological or geographical explorer can depend but little on the reports of the natives. The science of mind is certainly not less difficult than others, and as common sense fails elsewhere, so also here. Science in all directions is the correcting of common sense by deepest insight unaffected by ordinary utility. Hence, if the *questionnaire* method is worth working at all, it is only as a bare preliminary, simply as pointing out salient points for research. To secure any results of high value on the psychology of laughter would require the continuous service of several thoroughly trained and able psychologists who should work independently for several years and publish independent monographs. These men should be good physiologists, and should have a decided *penehant* for their work, and above all, have acute psychological insight in quickly and accurately realizing the states of mind implied by the most various activities. Their studies should be chiefly directed not upon observation of the very complex phenomena of laughter in civilized adults, but in the study of the evolution of laughter with infants and savages. Combined phonographic-photographic records of evolution of laughter with infants would be valuable. Pure savagery is fast fading from the globe, and the most pressing need for evolutionary psychology to-day, is a thorough study of the savage by psychologists of really eminent insight. Various scientific associations, biologic and others, send explorers and collectors to all parts of the earth, and it is high time that psychological associations do the same, and also provide a psychologist to go with all general scientific expeditions.

PSYCHOLOGICAL LITERATURE.

- (26) *Christianity and Idealism*. By JOHN WATSON, LL. D. The MacMillan Co., 1897. Price \$1.25.

This is a new and revised edition of Professor Watson's book, which first appeared a little less than a year ago. Several additions have been made to Part II. They include chapters on "The Failure of Materialism," "The Idealistic Interpretation of Natural Evolution," "Idealism and Human Progress," besides a dozen new pages in the final chapter, in which the author supplements his view of the relation of the human to the divine intelligence. The inadequacy of a mechanical metaphysic is shown in the chapter on materialism. Evolutionism as a philosophical principle succeeds better, for it explains the world as a rational unity. This unity is variously expressed in gravitation, chemical affinity, biological organism, and finally in the personal self. The chapter on human progress asks what is implied in this highest unity — the personal self. The answer asserts that the whole process of human evolution consists in "the gradual realization of reason in the individual and in society." Yet, this is no manifestation of a process hostile to the "cosmic" process, as Professor Huxley contended, nor is it antiithetic with a "religious feeling," which Mr. Kidd makes responsible for human progress. It is rather the self-conscious and self-determining principle which explains the lower as well as the higher stages of evolution — the "ultimate conception by means of which existence must be explained." The book certainly gains in interest and value by the introduction of the concept of evolution into the service of idealistic philosophy.

I. MADISON BENTLEY,
Cornell University.

- (27) *Sull' Importanza delle Ricerche relative alla Storia delle Scienze*.
DOTT. GIOVANNI VAILATI. Torino, 1897, 22 pp. 8vo.

This introductory lecture to a course on the history of mechanics emphasizes the need and the value of researches into the history of human thought, as seen in the development of the various branches of science. Dr. Vailati compares the disdain with which certain Greek philosophical schools looked upon such researches with the position of Malebranche, and those who held the Scriptures to contain all knowledge, and Adam to have been all perfect before the fall. The history of human opinions, bad or good, false or true, old or new, is of paramount importance. Every error indicates some reef to be avoided, though every discovery does not always indicate a path to be followed. The "science" of times gone by is as human as the science of the century in which we now are. From the knowledge of the development of science comes a true concept of the evolving human mind. Philogeny and ontogeny receive light from such investigations. Their pedagogical value is also very high. As scientist, to use the noble phrase, one can belong "to the masters of those who know," but as teacher, he must be "the masters of those who know not." Dr. Vailati points out that at the University of Berlin there are courses in the history of chemistry and of medicine; at Breslau, in the history of medicine, of mathematics and of botany; at Königsberg, in the history of astronomy; at Graz, in the history of ancient Greek scientific literature; at Wit-

tenberg a special course in the history of chemistry, and at Tübingen, Bonn, Vienna and Turin, courses in the history of medicine. At Vienna, too, Dr. Mach gave a course on the history of the mechanical theory of heat.

- (28) *Il Princípio dei Lavori Virtuali da Aristótele a Erone d'Alessandria.* Nota del DOTT. GIOVANNI VAILATI. Torino, 1897, 25 pp. 8vo.

This reprint from the "Proceedings of the Royal Academy of Turin" sketches briefly the history of the principle of energy from Aristotle down to Hero of Alexandria—the mechanical questions of the former and the elevator of the latter being treated in some detail.

- (29) *Il Tempo di Reazione semplice studiato in rapporto colla curva plethysmografica cerebrale.* PROF. M. L. PATRIZI. Reggio-Emilia, 1897, 15 pp. 8vo.

This article, reprinted from the *Rivista Sperimentale di Freniatria*, treats of simple reaction time in relation to the cerebral plethysmographic curve. The subject was Emanuele Favre, a boy of 13, a breach in whose cranium made such observations possible. The medium of 126 reactions for stimuli (auditory) when there was great cerebral volume was 332.5σ , when less (116 reactions), 345σ . The author concludes that (1) the oscillations of the specific activity of the cerebral cells and that of the circulation in the brain follow each its own course; (2) the strength of attention manifests itself with a greater rapidity of reaction times, and with a greater regularity of the psychometric curve, together with minor inequalities in the plethysmographic curve of the brain.

- (30) *I Reflessi Vascolari nelle Membra e nel Cervello dell'uomo per vari Stimoli e per varie condizioni fisiologiche e sperimentali.* PROF. M. L. PATRIZI. Reggio-Emilia, 1897, 85 pp. 8vo.

This detailed study, reprinted from the *Rivista Sperimentale di Freniatria*, is well furnished with curves and tables. The subjects were two boys of 13, Emanuele Favre at Turin and Edoardo Pardini at Sassari, the experiments extending over parts of two years, 1895-1896.

The author's conclusions are: (1) The vascular reflexes in man follow the fundamental laws of localization and irradiation, noted for the reflexes of relational life; (2) the localized vascular reflex takes place in less time than the radiated vascular reflex; (3) the brain exercises a clear influence on the activity of the spinal marrow, even in regard to the reflex movements of the blood vessels; (4) the time of vasal reflection in waking (for sensitive stimuli) is for the arm about 3", for the leg at about 5"; (5) the vascular reflex of the brain (for sensorial stimuli) has a latency not less than the brachial reflex for the same stimulus; (6) sleep induces a great retardation in the time of vasal reflection, diminishing from the brain to the arm, and inappreciable in the vessels of the lower limb; (7) the blood movements of the brain in sleep, consequent on stimuli, are, doubtless, active and autonomous reflexes; (8) the vascular reflex in the limbs for sensorial stimuli and psychic stimuli takes place in a time (4" in the arm) longer than the reflex for sensitive stimuli; (9) there is a vascular reaction for each sense stimulated; (10) some sensorial stimuli have greater capacity than others for provoking vasomotor reactions.

- (31) *La Terre champ de l'activité humaine.* M. L. GALLOUÉDEC. Rev. Scientif. (Paris), 4^e Série, Tome VIII (1897), pp. 262-271.

An interesting study of the relation of man to the planet on which he dwells, treating from a French point of view some of the questions discussed by Dr. W. J. McGee in his pamphlet, "Earth, the Home of Man," published in 1894. The influences of relief, situation, soil, climate, are touched up, and the great variation in the value of these factors in the course of human history emphasized. Man first conquered the hill-sides, then the plains, and now bogs and morasses, and even the loftiest mountains are yielding to his skilful attacks.

- (32) *Des conditions d'Arrêt ou d'Avortement de groupes humains.* M. F. SCHRADER. *Ibid.*, pp. 38-44.

According to the author, all changes, nothing is fixed—fauna, flora, customs, habits, civilizations, all pass away. The idea of nineteenth-century peoples that their civilization is stable, is fixed, will endure, is an illusion. Bordeaux will die when vineyards are no more in France. Spain died as lord of the Indies long ago. Egypt, as Herodotus said, is a "gift of the Nile." The cliff dwellers tell a tale of ease and comfort long disused. The Negritos of the Philippines, the Ainos of Japan, the Eskimo, the Lapps, the Bushmen, have all been driven to the wall. But some have their revenges. Resurging through the Spanish strata the old Aztec rules Mexico—in Chili, Peru, Brazil, the redskin's face appears again. It seems impossible entirely to suppress a people, a race. The survival of the fittest takes place even here. They persist who are sons of the soil and of the sun. The force of things makes them to be born again.

- (33) *Les Lois phoniques.* M. MICHEL BRÉAL. *Ibid.*, pp. 34-38.

Phonetic laws are neither fatal nor blind, says the distinguished linguist of the academy. Phonetic changes start from one individual, and unless they are welcomed, remain without effect and are soon forgotten. The practical study of phonetics, inaugurated by Gaston Paris, and since pursued with the aid of the phonograph and other instruments, has done much to re-orient us on the question concerning which the older authorities spoke so confidently.

- (34) *Le Transformisme et son interprétation en Craniologie.* M. G. PAPILLAULT. *Ibid.*, pp. 392.

The persistence of the medio-frontal suture in the skull, *c. g.*, of modern Parisians, and the existence of certain peculiarities in the region of the obelion, concerning which the author has written at greater length elsewhere, are manifestations of a progress, not a regression to an ancestral state, though they may be reckoned among the cases of atavism. The correlation of the metopic suture with intelligence is an interesting point.

- (35) *L'Inanition du noyau cellulaire.* S. M. LOUKIANOW. *Ibid.*, pp. 513-519.

The author gives some account of experiments from which he concludes that the cell nucleus as well as the body, are diminished by complete or incomplete nucleus, a diminution subject to particular laws. The cell nucleus therefore have a biological autonomy of their own. M. Loukianow thinks that our one great gift to the biology of the twentieth century will be not proof of the simplicity of the cell, but of its organic complexity.

- (36) *La fonction du Cerveau.* CHARLES RICHET. *Ibid.*, pp. 641-649.

The brain alone, of all the organs of the body, has consciousness and intelligence. The brain is the organ of the past, the medulla the organ of the present. In a word the brain is a memory apparatus.

- (37) *Les conquêtes de la Psychiatrie.* CÉSARE LOMERO SO. *Ibid.*, pp. 577-583.

The author notes some of the recent discoveries of psychiatry, "the new Prometheus, which is seeking to snatch away the secret of the nature of human thought." The study of the man of genius, the savage, the idiot, the child, reveals much of the complicated as well as the simple workings of thought. Hysterics, epilepsy, hypnotism, sleep, dreams, automatisms, psychic reactions, all bring their quota to the recognition of types and characteristic modes and degenerations of thought and action, to the understanding of the parallel between the phenomena of ideation (the highest and the least under control) and those of sensation (the humbler and most controllable). The conclusion of it all is the rather pessimistic view that "we live in the false, for the false, with the false; the true is only met with exceptionally in the world." Of the great mass of men in the world it may be said *fruges consumere nati*; the slave of habits, words, sounds even, they sacrifice to these the idea, and oppose research, discovery, truth, science. By sacrifice and suffering alone have great revolutions been accomplished.

- (38) *Y a-t-il des Nerfs spéciaux pour la Douleur?* PH. TISSIÉ. *Ibid.*, pp. 402-404.

The author states his agreement with the pain-centre theory of Richet, put forward in criticism of the views of M. Frédéricq, published last year.

- (39) *Zur Katatonie-Frage. Eine klinische Studie.* Von SCHÜLE (Illenau). *Allg. Ztschr. Psych.* Berlin, LIV Bd. (1897), S. 515-552.

An extended criticism of the view, first fully set forth by Kahlbaum in 1873, that katatonia was a special clinical form of disease. After examination of the katatonic phenomena, the author concludes that the clinically independent status of the affection has not yet been made out—much less the idea of "a katatonic motility-nemesis." It is merely a "gathered-up" name, a heuristic appellation for the most diverse motor stimulation and inhibition symptoms.

- (40) *Zur Pathologie der Epilepsie.* DR. MED. N. KRAÏNSKY. *Ibid.*, 612-665.

The general results of the extended experiments of Dr. Krainsky of Charkow seem to indicate that the blood is the carrier of the epileptic poison. The author made special investigations of the chemical nature of the reactions obtained.

- (41) *Die Hypothese der spezifischen Nervenzellenfunktion.* DR. FRANZ NISSL. *Ibid.*, S. 1-107.

This is an elaboration of the address delivered before the annual meeting of German psychiatrists at Heidelberg in September, 1896. More than 60 pages are taken up with the explanation in detail of the four plates (eight figures), by which the article is accompanied, and other illustrations not there given.

- (42) *Acute Manie.* DR. M. J. VAN ERP TAALMAN KIP. *Ibid.*, S. 119-135.

From investigation of 856 patients (men 413, women 443), in the asylum at Dordrecht, the author doubts the correctness and the desirability of the term "acute mania," as well as its independent existence. "Periodic madness" is better.

- (43) *Ist die progressive Paralyse aus den mikroskopischen Befunden an der Grosshirnrinde pathologisch-anatomisch diagnostizierbar?* Eine literarische und anatomische Studie. DR. OTTO MAR SCHMIDT. *Ibid.*, 178-207.

After a careful review of the literature of the subject, Dr. Schmidt of Würzburg says that safe, convincing pathological diagnoses of progressive paralysis are still too much lacking to justify dogmatism.

- (44) *Ueber die Pathogenese des Delirium Tremens.* DR. J. E. JACOBSON. *Ibid.*, S. 221-270.

Based upon the study of 300 cases of *delirium tremens* personally investigated concludes that "the toxic plus" is not the real deeper cause of the delirium outbreak; the latter is to be found in the chronic alcoholization of the brain.

- (45) *Physiologische Genese der Paranoia.* DR. LUIGI RONCORONI. *Ibid.*, S. 336-372.

From examination of the literature and personal investigation of 100 cases (men 80, women 20), Dr. Roncoroni of Turin comes to the conclusion that genuine paranoia belongs to the first group of paraphrenias without automatic influencing of motility, induced essentially by abnormal hereditary constitution of the psychic functions, which may lead on purely parapsychological grounds to the development of the psychosis. Genius is often in touch with both the genuine and the rudimentary paranoia. But genius never is tied down to a single form of psychosis and congenital forms proponderate with it.

- (46) *Théorie des Emotions.* JULES SOURY. Ann. Méd.-psychol. Paris, VIII^e Série, Tome VI (1897), pp. 247-262.

In reviewing recent studies of blushing (Pitres and Régis, von Bechterew, etc.) and less recent general discussions by James, Lange, Sergi, Marillier, Kraepelin, Wernicke and others, the author concludes as follows: The mechanism of the muscular, articular, tendinous, cutaneous, etc.; consciousness, that of the notion of position and of innervation of the different parts of the body, of the state of the circulation, respiration, secretions and excretions, appears to be in all points identical with the mechanism of the consciousness of moral and intellectual emotions. In both cases we have only to do with a kinesthesia of the organic modifications provoked by excitations of the internal or the external milieu and transmitted to the central nervous system. A. F. CHAMBERLAIN.

BOOK NOTES.¹

(G. S. H.)

- (47) *Grundlegung der Neusokratischen Philosophie.* Von DR. HEINRICH GOMPERZ. Leipzig, 1897.

The new Socratic school of religious faith was founded in 1890 by Leo Haas. It is a community whose creed is the Socratic faith that "no evil can befall a good man living or dead." This belief rests on

¹ Notice in this section does not preclude fuller review later.

no facts or arguments, but is firm, subjective, eternal, supermundane.

Mr. Gomperz' purpose here is, nevertheless, to show that this faith corresponds with the latest results of science, and to make propaganda. This conviction gives a feeling of independence, was the life principle of the great sage, has its correlate in the idea that all virtue is in knowledge. What has real worth in us is indestructible, and this is *Gemüth* understanding and character, which are the three elements of personality. This resists and negates evil. Three ways lead to the *paidia* or free and joyous activity, viz.: right thinking, willing and feeling. This state gives an impermeability for which the world seems a divine comedy. Evil is only to be overcome and good only to overcome it.

- (48) *Ueber die Raumwahrnehmungen des Tastsinnes, ein Beitrag zur experimentellen Psychologie.* Von DR. VICTOR HENRI. Berlin, 1898, pp. 228.

We have here at last a comprehensive work on the dermal space sense with a bibliography of 322 titles, based on a broad historical knowledge, and making important new experimental contributions to the subject.

Part I is devoted to a gathering of the facts (a) of dermal space sense generally, (b) localization of tactile impressions, (c) physiological and pathological facts. Part II continues a presentation and discussion of theories (a) touching the origin and development of the spatial element, nativistic and genetic, (b) biologico-psychological sketch of the spatial perception of touch.

- (49) *Magic, Stage Illusions and Scientific Diversions, including Trick Photography.* Compiled and edited by Albert A. Hopkins, with an introduction by H. R. EVANS. 400 illustrations. Munn & Co., publishers, New York. pp. 556.

At last we have a really valuable treatise on sleight of hand, prestidigitation, with explanations and a copious bibliography. The volume is almost elegantly gotten up and will prove a mine of both suggestiveness and illustrations for empirical psychologists. The topics best treated are stage disappearances, optical tricks, conjuring, juggling, fire-eating, sword tricks, ventriloquism, animated puppets, shadowgraphy, ancient magic, stage effects and modern stage and theatre secrets, curious toys, etc. Although the order of topics is open to criticism, the book is the product of long and careful compilatory study by a real lover of the topic, who knew Heller and many other magicians, and who intersperses his pages with many personal reminiscences.

- (50) *Karl Ernst von Baer und seine Weltanschauung.* Von DR. REMIGIUS STÖLZLE. Regensburg, 1897, pp. 687.

This Wurzburg professor of philosophy writes the life of the great founder of modern embryology in systematic wise, treating in order the sources of Baer's view of the world and his relation to philosophy and the theory of knowledge, the problem of cosmology, biology, anthropology, religious philosophy, philosophy of history, ethics, pedagogy and politics. The range of Baer's thought is amazing, and he is fortunate in his biographer.

- (51) *Problems of Nature.* By GUSTAV JAEGER. New York, 1897, pp. 261.

The "researches and discoveries" of the well-known author, not only of the Jaeger costume, but of the smell theory of the soul, are here selected from his published writings and translated in fourteen

short zoölogical and twenty-eight anthropological papers, with four "varia," in Part III. An autograph letter of Darwin to the author is reproduced in fac-simile, expressing the "highest degree" of interest. In essays of three or four pages each, the author summarily states the organs of life, the origin of species, inheritance, the animal soul, infection, spirit and intellect, the origin of language, and many other theories of greatest interest. The author is bold and often stimulating and novel, but seems to me very superficial and unread in his field.

- (52) *Zur Psychologie der Frau. Erstes Theil.* LAURA MAHRHOLM. Berlin, 1897, pp. 355.

This is the first book by a woman on the psychology of her sex. Catholic women have a closer connection with nature and a wider sphere of emotional expression than Protestant women. Their work is social and a sexual psychology of woman will follow. The period of thought has lasted 400 years, but a period of feeling is at hand, and with this will come the day of woman. She represents the instinct-feelings. The book is both brilliant and suggestive.

- (53) *Wagner's Ring of the Nibelung and the Conditions of Ideal Manhood.* By DAVID IRVINE. London, 1897, pp. 281.

Wagner said this contained his entire view of the world, and that it was essentially at variance with established conceptions. He is like Browning in the bitterness of his enemies, and the ardor and activity of his apologists. The deeper we go the better we understand the Ring. It treats the great problem of renunciation. Consciousness exists to show us the needs of our common nature and how we may conform to it. Only music can fully reveal even to feeling the profound significance of Wotan's tragic abdication. To hold that a state lives solely on the vices of society, and that the only monopoly any church can claim is that of its errors, for the truth is common to all, suggest's Wagner's motto, "Destroy, yet redeem." In the twilight of the gods, the new man of the future is born.

- (54) *Vocabulaire de L'Angelologie.* Par MOISE SCHWAB. Paris, 1897, pp. 318.

This is a dictionary of angels, demons and other spiritual beings, based on 1,300 Hebrew manuscripts (mostly before the eighth century) in the *Bibliothèque Nationale*, extracted from memoirs presented by various savants of the Academy of Inscription and Belles-Lettres. The Cabalistic demonology reflects very different grades of intelligence, and many of the terms are ungrammatical and unlogical. The angels form ten degrees and are often also allegorical. Both together personify every human faculty and passion, vice and weakness, are in every ray of light, whirlwinds of dust, etc. Stars are sylph-like dreams in gnome-like nightmares, and many are personified as Gabriel, Michael, Raphael and Sabaoth. They were invoked by many conjuration formulæ, and the letters of the names were full of symbolism, and names and letters subjected to many forms of permutation and combination. In all there are over 3,000 of these terms.

- (55) *Folie des Femmes Enceintes, etc.* Par DR. A. PARIS. Paris, 1897, pp. 131.

A brief hand-book including the history of the subject, typical clinical cases, cause, symptoms and treatment.

- (56) *Zur Geschichte des Entwickelungsbegriffs.* Von DR. L. MARIN-POLSKY. Berne, 1897, pp. 120.

This memoir is in the series of studies in philosophy and its history edited by L. Stein, and now in its sixth volume. Evolution begins with Heraclitus. Then follow the stoics, Telesius, Bruno, Hobbes, and with the latter the truly scientific treatment of the problem of evolution begins.

- (57) *The Development of the Frog's Egg. An Introduction to Experimental Embryology.* By THOMAS HUNT MORGAN, Ph. D., Prof. of Biol., Bryn-Mawr College. N. Y., Macmillan Co., 1897, pp. 192.

The author attempts to give a continuous account of the development of the frog's egg from the time when it is first forming to the moment when the young tadpole emerges from the jelly-membranes, and to bring together the most important results of studies bearing on the topic. Special emphasis is laid on the results of experimental work in the belief that the evidence from this source is the most instructive. The work suggests Wilson's valuable memoir on the cell and treats similar topics.

- (58) *Die Historische Entwicklung des Experimentellen Gehirn und Rückenmarks-physiologie vor Flourens.* Von DR. MAX NEUBURGER. Stuttgart, 1897, pp. 356.

The first part of this work is devoted to Willis, the second to Haller and his contemporaries, and the third to Magendie, Bell and Flourens.

- (59) *Sur la Génération de la Voix et du Timbre.* Paris, 1897, pp. 392.

The author declares that since Helmholtz we have been living under a delusion which has checked all progress, and offers a new aerodynamic theory of acoustics in place of his. Little mono and di-clonal anticyclones cause sound and the tympanum originates timbre.

- (60) *Essai sur les conditions et les limites de la certitude logique.* Par G. MILHAUD. F. Alcan, Paris, 1898, pp. 203.

Part I treats the conditions of logical contradiction, Part II the conditions of logical certitude in mathematics, both pure and applied; Part III, special problems illustrating the principle of contradiction; viz., liberty and mechanism, non-Euclidean geometry, Kant's Mathematical Antimonies. The book is an argument that we must renounce logical certitudes in the domain of reality.

- (61) *Comment naissent les mythes.* Par PAUL REGNAUD. Paris, 1898, pp. 251.

This little work is a detailed and interesting attempt by a distinguished Sanscrit expert to prove that all Indo-European mythology originates in verbal substitutions and personifications. This thesis is illustrated at length in three mythic themes: e. g., the Vedic sources of Petit Poucet, the Hindu legend of the deluge and Pusuravas and Urvaca.

- (62) *Problèmes d'Esthétique et de Morale.* Par C. R. C. HEREKEM-RACH. F. Alcan, Paris, 1898, pp. 163.

The beautiful, sublime, tragic and comic each have a circa twenty-page chapter, and the rest of the volume describes the evo-

lution of moral sentiments, motives of conduct, and the relations between ethics and sociology. The author is a professor in a Dutch Lycée, and writes in a style of unusual elegance.

- (63) *La Personne Humaine*. Par L'ABBÉ C. PIAT. F. Alcan, Paris, 1897, pp. 404.

In Book I, Perception, the author enumerates and criticises the data of consciousness and of science. Book II discusses whether reflection is a result of an organic process, commences in instinct and appears in the language of animals. Book III treats of responsibility in its relation to science, conscience and reason. In fine, human personality is something more than a synthesis of conscious and sub-conscious states; phenomenism will not suffice. A higher synthesis of all the facts of personality is needed. Man should wish to be not merely a person, but to be the species.

- (64) *In Search of a Soul*. By HORATIO W. DRESSER. Boston, 1897, pp. 273.

This is a series of essays on interpretation of the higher nature of man, and discusses the reality of the soul, absolute and higher self, reincarnation and karma, spiritual force, soul, etc., from the standpoint of what may be called the higher Christian science.

- (65) *Etudes d'histoire de la philosophie*. Par EMILE BOUTROUX. F. Alcan, Paris, 1897, pp. 443.

This accomplished professor of letters at the Sorbonne here prints seven of his best papers, *v. g.*: Socrates as founder of moral science, Aristotle, Jacob Boehme, Descartes, The Relation of Morals and Philosophy in his System, Kant, and The Influence of Scotch upon French Philosophy.

- (66) *Théories Modernes sur les Origines de la Famille de la Société et de l'état*. Par A. POSADA. Paris, 1896.

This work translated from the Spanish is a convenient and able summary, and discusses the theories of Maine, Sumner, Bachofen, McLennan, Morgan, Lubbock, Giraud-Teulon, Starckes, Spencer, Coulanges and Ihring. Political society is first and the family develops with, but under it.

NOTES AND NEWS.

Dr. W. H. R. Rivers of St. John's College has been appointed to the recently - established university lectureship in experimental psychology at the University of Cambridge. Dr. Rivers has given courses in sense physiology and reaction-work at Cambridge and at University College, London, for some years past. He has published several studies in optics and (in conjunction with Professor Kraepelin) has written upon the question of mental fatigue.

We have received the first few numbers of a new fortnightly, the *Intermédiaire des Biologistes*, edited by Mm. Binet and Henri, with the assistance of a large corps of French and foreign biologists. The publication forms a sort of "Notes and Queries" in the biological realm. Psychology figures largely in its pages, and the names of Baldwin, Bechterew, Ebbinghaus, Forel and G. E. Müller occur in the list of collaborators. The *Intermédiaire* promises to be of great service to psychologists, and especially to those of the experimental school.

Professor Titchener's *Primer of Psychology* will appear in January. It follows the experimental method throughout, and gives full directions to teachers for procuring apparatus and materials.

Dr. A. Allin succeeds Professor Russell in the chair of psychology and pedagogy at Colorado University. Dr. F. Kennedy has been made demonstrator in experimental psychology at Princeton University.

Professor Baldwin's presidential address at the Cornell meeting of the American Psychological Association dealt with the topic of "Selective Thinking." It was an amplification of the treatment of the same subject in the speaker's "Social and Ethical Interpretations in Mental Development."

The Cornell laboratory has recently acquired a new room, 9x22 feet, which will be devoted exclusively to experiments upon the senses of smell and taste. The laboratory now possesses ten rooms.

BOOKS RECEIVED.

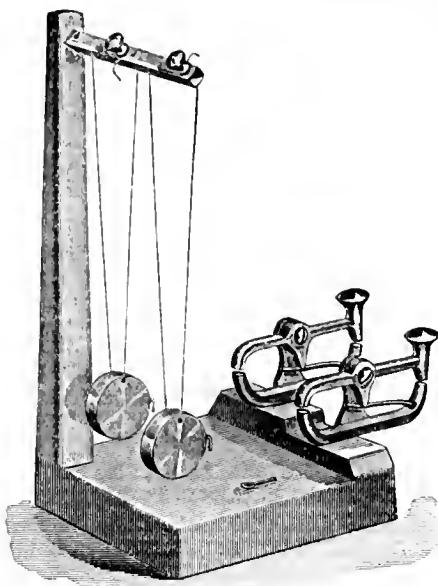
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BLONDEAU, CYRILLE. *L'absolu et sa loi constitutive.* F. Alcan, Paris, 1897, pp. 350. Price, Frs. 6.

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LE DANTEC, F. *L'Individualité et l'erreur individualiste.* F. Alcan, Paris, 1898, pp. 175. Price, Frs. 2.50.

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- GOMPERZ, HEINRICH. *Grundlegung der Neusokratischen Philosophie,* pp. ix-154. Franz Deuticke, Leipzig u. Wien, 1897. Paper, M. 2.50.
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- MANACÉINE, MARIE DE. *Sleep: Its physiology, pathology, hygiene, and psychology,* pp. vii-341 (*Contemporary Science Series*), Charles Scribner's Sons, New York, 1897. Price, \$1.25.
- MASON, R. OSGOOD. *Telepathy and the Subliminal Self.* An account of recent investigations regarding hypnotism, automatism, dreams, phantasms, and related phenomena. Henry Holt & Co., New York, pp. viii-343. Price, \$1.50.
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GROWTH OF CHILDREN IN HEIGHT AND WEIGHT.*

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For the past few years the province of psychology has been rapidly extending. While tradition has sought by means of definitions and classifications, epistemological or ontological, to maintain sharply defined limits, nevertheless practical thought and investigation have done and are doing much to break down these formal barriers, as we realize when we turn from our Sir William Hamilton to Wundt, from Bain to Lloyd Morgan, from McCosh to James. This does not necessarily mean that the past is wrong, but it at least signifies

*A bibliography will be found at the conclusion, numbered and in alphabetical order. The names of all contributors mentioned in the text will be found in this bibliography. In cases where one individual has contributed more than one article, or confusion for any other reason may be possible, the bibliography number will be found in the text as a means of readier reference. For page references a dagger (+) will indicate that the page number will be found as a footnote.

This article constitutes the preliminary first part to a general review of the studies which have been made upon the physical and mental development of children during the years usually spent in the common schools, more particularly the primary school. It aims (1) to present the salient facts from these studies rather than to draw general conclusions; and (2) to serve those who have occasion to investigate these fields as a pathfinder to sources of information. Dealing with the child only to the end of his common school period, this review touches upon the phenomena of adolescence only incidentally. President G. Stanley Hall's book upon adolescence, shortly forthcoming, will review exhaustively not only the adolescent field, but also will treat in a larger philosophic way the general principles of growth and development.—F. B.

that psychology is growing, that the present is bigger than the past, that there is in modern investigation a spirit seeking organic relations which the formalism of old conceptions is powerless to withstand. Any systematic study of genetic psychology at the present juncture begins with the phenomena of physical growth. Not that up to this time a code of definite principles of growth has been formulated, but the dominant tendency of modern mental science has been to correlate more closely the mental and physical. Definite and final conclusions showing the exact and specific relations of this element to that are hardly matured, but a large number of investigations have been made, and for proper orientation towards educational problems of the present, the educator must have acquaintance with the trend of these investigations. Some bold attempts have been made to strike out direct relations between mental capacity and forms of physical growth, as, for example, Dr. Porter, from an examination of St. Louis children, concludes that the taller and heavier children at a given age are, on the average, mentally brighter. While perhaps we may be yet far from definite conclusions upon any of these problems, it is clear that the numerous studies suggesting the dependence of mental development, through physical development, upon age, nutrition, race, sex, climate, height, weight, etc., necessarily form the logical starting point of a pedagogical study of children.

We shall commence, therefore, with a review of the studies upon growth in height and weight, and later consider various other elements which have been put forth as conditioning factors of mental development. We have little data for growth from birth to six years,* for the reason, of course, that children in masses are not accessible until they go to school. We know very little of growth after the seventeenth or eighteenth year, for the same reason. Within the school ages, interest has centred largely upon pubertal growth, and the years from six to eleven or twelve have been somewhat neglected. Several attempts have been made to classify growth into periods. There is universal agreement that three periods are distinctly discernible — a period from birth to puberty, a period during the progress of pubertal changes, and a period after these changes; but attempts to break up these periods into smaller ones as yet lack general assent upon any exact basis of serviceable classification.

Vierordt (¹⁸) divides growth into seven periods, as follows: first, sucking period, from birth to first teething in seventh or

* The most complete treatments of this period will be found by Camerer (^{22, 23}), Daffner (^{27, 28}), and Vierordt (^{24, 26, 25}).

(²⁶) P. 601.

eighth month, in which the breathing, digestion and senses begin their specific activities; second, later child age to the second dentition, in seventh or eighth year; third, to puberty in fourteenth or fifteenth year; fourth, to complete development in height in twenty-first or twenty-second year; fifth, early adult age; sixth, later adult age to sixtieth year; seventh, old age. Liharzik somewhat arbitrarily divided the first twenty-five years of life into twenty-four periods. Zeissing (⁹¹) found three: first, one of decrease in the yearly increments of growth up to nine years; second, increase of yearly increments to the seventeenth year; and third, a later decrease. Hartwell (⁵⁰) follows this division upon the physiological grounds that during the first period the brain practically completes its growth, and the child is sensory rather than motor. Axel Key (⁹⁹) finds, first, a period 6 to 8 years of moderate annual increase; second, a period 9 to 13 years of least increase; third, a period 13 to 17 of greatest increase, and a period 17 to 19 of decreasing rate of increment. Combe makes two periods during school age: 7 to 10 and 14 to 17 in boys, and 7 to 12 and 12 to 15 in girls. Lange finds four periods: first, birth to 2 years, highest rate of growth; second, 2 to 12 years, decreasing annual increments; third, 12 to 15 years, mental growth; fourth, 15 to 21 years, a sudden decrease in annual increments.

The question of the point at which growth matures is one which has reached, as yet, no definite conclusion. Certainly there is no disagreement upon the fact that under normal conditions, no material increments of importance occur after the nineteenth year, though unquestionably there is increase of theoretical value up to the twenty-first or twenty-second year, if not until very much later. Growth in height certainly matures before growth in weight.

Quetelet (¹⁵⁰) put maturity at the 30th year in men, and 25th year in women. Beyer (⁹) thinks we must add at least an inch to the average height for growth after the 19th year. Roberts' tables would indicate a maturity in weight at 22 for men, and at 19 for women. Baxter (³) found an increase in stature in men up to the 35th year, though he places the average age of maturity earlier. Villerme puts the age of maturity in males at 23, and Liharzik at 25. The Report of Committee of Anthropometry (³⁷) places the maturity in height of women at 20 years, and of men at 23 years.

STATURE.

The average length of new-born male infants has been generally taken as 50 centimeters (19.68 inches), and about one-half centimeter (approximately one-fifth of an inch) less for females (¹⁹⁴).

Other averages given by Vierordt (⁹¹) are as follows:

	Males.	Females.
Russow,	50 cm.	49.5 cm.
Quetelet,	50	49.4
Kézmarsky,	50.2	49.4
Fesser,	51.5	50.5
Wagner,	47.4	46.75
Roberts,	49.1	48.0

(⁸⁰) P. 170.

(⁹⁴) P. 2.

The Anthropometric Committee (³⁷) from 451 males and 466 females in the hospitals of London and Edinburgh gives the average as 19.52 inches for boys and 19.32 for girls. Out of the 451 males, 133 measured 20 inches, 116 measured 19 inches, and the limits were from 15 to 24 inches. In the case of females, the limits were from 16 to 23 inches, and of the 466 cases, 131 were 19 inches, 117 were 20 inches, and 109 were 18 inches.

Vierordt, quoting Fasbender, finds that the average first-born children are about .43 cm. shorter than later born. On the other hand, Beas (¹⁴) finds that first-born children distinctly exceed later-born children in stature as well as weight from the 6th year to the 15th in males, and until the adult state in females.

During the first year the child grows at the most rapid rate of its entire life. The average increase is probably between seven and eight inches. The rate of growth decreases rapidly from month to month of the first year, and in general it may be said that the rate decreases with age. However, as will be pointed out, there are important fluctuations which modify this rule. There are no data from large numbers of children available by which to determine the growth nor its rate up to five or six years.

Russew finds that in the first month of life the infant grows 12½ per cent. of its height; the rate steadily decreases and in the twelfth month is 3 per cent. D'Espine and Picot (³⁸) give similar figures.

At one year of age, the child is on the average 70 to 75 cm. in length, showing an increase of about 50 per cent. for the first year. Russew (³⁹) gives the length, at one year of age, as 73; Bencke, 70; Hahner, 75; Liharzik, 80 cm. (⁴⁰) D'Espine and Picot give the lengths of each year as follows: first, 19.8 cm.; second, 9.0; third, 7.3; fourth, 6.4; fifth, 6; next ten years, 6 cm. Zeissing's lengths are as follows: 23.2, 10.6, 8.7, 7.5, 5.9, 6.6; Daffner (²⁷), for boys, 21.9, 11.42, 6.56, 4.76, 6.34, 3.03,—for girls, 22.5, 12.11, 6.28, 6.49, 6.1, 4.3, 3.6.

The rate of growth in this early period, so far as data indicate, is practically the same for both sexes. Starting at birth slightly shorter than boys, the girls at six years of age are only a fraction of an inch shorter.

Roberts, 1.7 in.; Gilbert (⁴⁴), .5 in.; Peckham, .3 in.; Oakland, .3 in. (girls taller); Danish (⁵¹), .0; Swedish (³⁹), 1.2 in.; Geissler and Uhllitz, .3 in.; Porter, .5 in.; Geissler, .4 in.; Bowditch (¹⁹), .4 in.; Quetelet, .6 in.

Between 6 and 7 years of age, the average American child measures about 44 or 45 inches. This is an increase of 24 or 25 inches for the first six years of life, or about 43 per cent. of the length at birth. At 12 years of age American boys are on the average about 55 inches in height, an increase of 10 or 11 inches for the six preceding years; this amounts to an increase of about 20 per cent. or less of the height at 6 years—less than half the percentage rate for the first six years. Until

(³²) See, also, Reitz, "Grundzugie d. Therapie des Kindesalters," 1883, p. 22; Vierordt, "Daten n. Tabellen," p. 3.

10 to 12 years, there is no material difference between the heights of the sexes; but during these two years, varying with localities, the girls begin to grow faster than boys, and for the two or three years following are actually taller (Table A). During the 14th or 15th year, this rate materially slackens, and though girls grow slowly for two or three years longer, they have practically completed their growth in height, generally at the age of 15, as a glance at the tables of increases will show. The rate of accelerated growth in height, in the case of boys, begins during the period 12 to 14 as a rule. Boys are slower in reaching their maximum rate and therefore grow rapidly a longer time. They overtake the girls usually in the 15th year, and by the end of the 16th year or later, their period of accelerated rate ends. Until the 11th year or thereabouts, as stated, there is no material difference in the height of the two sexes. We have therefore to consider two distinct periods in the growth of an individual: first, the period before the rapid acceleration sets in until the 11th or 12th year in girls and the 13th or 14th in boys; secondly, the period after this accelerated rate sets in until maturity. The first period of growth includes that of the first five or seven years in school.

If now we glance at Table A of heights, taking, for example, the larger American studies of Bowditch, Peckham and Porter, we see that the rate of growth is somewhat rapid in the beginning, the 6th or 7th year, and decreases with fluctuations until about 10 years in girls and 12 years in boys, when the prepubertal acceleration sets in. This general decrease is to be observed in the case of all larger studies, though the year of the beginning of the prepubertal increase varies a year or so. The same decrease in rate from six years up to the time of the prepubertal increase is to be observed similarly in the case of girls. Curves constructed from absolute annual increases show, as a rule, in this childhood period one or two pronounced fluctuations, but they do not occur with a regularity in all charts sufficient to be of assurance that their cause is certainly physiological and not merely statistical. Nevertheless it will be observed that the curves are by no means regular. Growth seems to be by rapid increases followed by resting periods, by fits and starts as it were.

Gilbert (⁴⁴) and Peckham have called attention to one such fluctuation, a decrease of rate in the 8th or 9th year, and suggest as a cause the second dentition.* Vierordt (⁴⁵) makes the second den-

* Camerer's curves (²⁷) show very conclusively a halting of growth at the first dentition in infancy, and he unqualifiedly recognizes this cause.

(⁴⁵) P. 601.

tition a physiological division line between two periods of childhood. Hartwell (⁴⁹) makes a physiological period end in 7th or 8th year, since the brain practically completes its growth at this period. This would seem to suggest a possible resting period for the bodily development.

On the whole, in the absence of any determinative data upon exact details, it is perhaps safer to regard the period from 6 years to the prepubertal increase as a general decrease in the rate of growth with one or two minor fluctuations. The investigations of Combe, Landsberger and Carstadt, made upon a comparatively small number of children, but more upon the plan of individual measurements, tracing the growth of individual children for a number of years, justifies this view.

If we subtract the average height at 6 years from the average height at 12 years for boys, we obtain from each of the three large American investigations approximately the same increase for the 6 years: Boston, 11.4 in.; St. Louis, 11.5 in.; Milwaukee, 10.9 in. The increases of girls, owing to earlier appearance of the prepubertal acceleration, can be taken only from 6 to 10 years. These increments are as follows: Boston, 8 in.; St. Louis, 8.2 in.; Milwaukee, 8.1 in.

Combe, who estimated the annual increases by grouping children of the same age in months, concludes: "The increase in boys to 14 and in girls to 11 is very regular, and varies only about a millimeter more or less. The twelve curves, which represent the monthly averages, constitute a narrow bundle of almost always parallel and seldom crossing lines."

Landsberger in Posen says: "The average yearly increase in height during the school age (6 to 13) can be taken in all zones as between 4.5 to 5.5 cm. with some safety—for the first half somewhat greater and for the last half somewhat smaller." Of course, he makes a mistake in applying this rule to girls, who in many localities are in 13th year already reaching their maximum of acceleration.

West (¹⁰) says: "If we compare the mean differences between the general average and the averages for the six American cities (Boston, St. Louis, Milwaukee, Toronto, Worcester, Oakland) in weight and stature, we find that until about the 11th year the children develop with comparative uniformity, but from that age the modifying effects of descent and surroundings are beginning to act, causing the mean differences to increase very markedly."

TABLES AND CHARTS.—Table A gives the heights of children during the growing period. It is practically complete to date for the larger general investigations which have been made. In the originals of most of these the data have been given in centimeters, but these have been expressed in inches. In a study of them caution should be taken on a few matters. The extremes, those of the beginning or concluding ages in many cases, are based on a smaller number of measurements than the middle period. In some cases these doubtful averages have already been omitted. The figures of Dr. Porter for St. Louis are not comparable with the others, for the

(⁵⁰) P. 57.

son that he reckoned age by "the nearest birthday," while all others use the last birthday. Since an average of a year's ages is based upon children from the beginning to those born 364 days later, an average really gives, in all tables except that of Porter, the height of a child in the middle of the year. For example, the average height given of children 7 years really means the height of a child $7\frac{1}{2}$ years, assuming of course that ages are evenly distributed in time. In the case of Dr. Porter, however, who counts as 7 years of age children $6\frac{1}{2}$ to $7\frac{1}{2}$ (*i. e.*, the nearest birthday), the average is at 7 years, or 6 months younger. This explanation also applies to the weights. In almost all investigations the children were measured without shoes. In one or two instances (*e. g.*, Gilbert) shoes were worn. So far as known, these facts are stated at the head of each column.

Table B shows the absolute annual increases obtained from Table A by subtracting the average height of one age from the next.

Table C gives the "percentage" or "relative" annual increase. The rate of increase has generally been determined merely by the absolute annual increase. But such a method neglects to take into account the different heights of the different years, and it is perhaps unfair to say because a large boy increases slightly more than a small boy, that therefore he is actually growing faster. Relative to their respective sizes in the beginning, the small child may make a larger increase in proportion to size. As Porter points out, it would be fairer to find in each case the percentage of his own size which each boy grows (by dividing the year's increase by the size at the beginning of the year). Minot also indorses the system of percentages. He says: "In the writings of Quetelet, Cowell, Roberts, Gould, Pagliani, Street, Boulton, Liharzik, Bowditch and others, the rate of growth is discussed, but I am compelled to consider that they have all misapplied the term. They compare the index of the rate, the actual, absolute increments of equal successive periods; but since during each period the size of the body increases, then if the rate of growth were constant, the proportionate increment would remain the same, but the absolute increments would become steadily larger. Reciprocally, it is evident from this that if the absolute increments are constant, the rate of growth diminishes, a point which, so far as I am aware, has been entirely overlooked hitherto."

Chart I represents graphically the increases in height.

In connection with the height, Chart III should be consulted, showing the growth in height of the average American child, and also his absolute and percentage annual increases.

WEIGHT.

There has been some discussion upon the question whether height or weight is the better index of fundamental growth conditions. Donaldson (^{†²⁹}) decides in favor of weight, for the reason that while the body increases in stature from birth to thirty years only 3.37 fold, in volume the increase is 20.66 fold. He thinks, therefore, that weight is a better index of the complex changes which growth implies. His view is not held by the majority of anthropometrists. The general view is rather in favor of using height as the index. Increase in

(²⁹) Pp. 49-50.

weight varies irregularly throughout life, depending intimately upon external conditions. The absorption of water and the accumulations of fats which constitute elements not properly considered increments of permanent significance, render it impossible to determine the essential growth, by weight.

Vierordt (³⁴) concludes that the average weight of the male at birth may be put at 3,333 grammes (7.3 lbs.), and of females at 3,200 grammes (7.1 lbs.)

Vierordt gives the following averages:

	Boys.	Girls.
Spiegelberg, Breslau,	3,201 gr.	3,056 gr.
Gregory, Munich,	3,355	3,386
Schutz, Leipzig,	3,399	3,233
Ingerslev,	3,381	3,280
Kézmarsky, Perth,	3,383	3,284
Qnetelet, Brussels,	3,100	3,000
Wagner, Königsberg,	3,479	3,339

The Report of the Anthropometric Committee (³⁷) from data of 451 boys and 466 girls in London and Edinburgh hospitals, places the average of boys at 7.1 pounds and of girls at 6.9 pounds. Roberts (³²) from data of 100 English new-born children, finds that the boys range in weight from 3 to 12 pounds, but that 87 per cent. are between 6 and 9 pounds; the females range in weight from 4 to 11 pounds, and 85 per cent. are between 6 and 9 pounds. Elsässer, in Stuttgart, from 1,000 observations, finds that 976 children vary from 5 to 9 pounds (German).

Siebold, from data of 3,000 new-born infants, finds the extreme variations from 4 to 11 pounds (German); only 169 fall outside of the limits of 5½ to 8½ pounds. Fasbender (³³) finds that first-born children average 189 grammes lighter than later born, but the relations seem to change later, for Boas (¹¹) concludes that after the sixth year first-born children are heavier as well as taller than later born.

The development by weight seems, on the whole, to follow the law of development in height. The weight at birth is almost trebled during the first year. The rate of growth decreases very rapidly at first, more slowly later, and up to the period of maturity shows fluctuations indicative of periods of rapidity followed by periods of comparative rest.

The period of infantile growth in weight and that of the period up to six years will be found reviewed by Vierordt (³³, ³⁴, ³⁵). The more important recent contributions are those of Camerer (²², ²³) and of Daffner (³⁷).

Up to the period of prepubertal growth, there is no material difference in the absolute average weight of the two sexes. At 6 years, a comparison of the average weights, as given in the table, will show that the sexes vary less than two pounds, with the advantage in favor of the boys. From six to ten

(³⁷) P. 34.

(³²) P. 79.

years the increase weight in pounds is as follows for American investigations :

	Boston. (Bowditch)	St. Louis. (Porter.)	Milwaukee. (Peckham.)	Oakland.	Worcester. (West.)	New Haven. (Gilbert.)
Boys,	20.1	18.7	20.6	19.1	19.0	21.6
Girls,	19.1	18.9	19.4	17.3	19.5	18.4

There seem to be one or two fluctuations of weights, periods of activity and of rest, apparently between six years and the prepubertal acceleration. This is more marked and more irregular in girls than in boys. As a rule in the case of boys there is to be observed a general rising tendency culminating usually in the 8th, 9th or 10th year, followed by a sudden decrease to its lowest point just before the prepubertal increase. In the case of girls, the ebb tide of growth preceding the prepubertal acceleration is easily distinguishable in all the curves, but the previous rhythms are more irregular. The acceleration period in boys begins from the 11th to 13th year, and ends usually with the 16th, the year of maximum increase being the 14th, 15th or 16th. In the case of girls, the beginning is a year or two earlier than in boys, and is ended usually in the 14th or 15th. It is shorter in duration than the same period in boys.

As in growth in height, owing to the fact that the girls' acceleration begins and ends earlier than that of boys, girls are taller than boys for a period of two or three years. It is interesting to note that this law holds for the Japanese (⁷¹), a race distinct from the Europeans. The acceleration in girls begins in the 11th year, and they surpass boys in weight until the 15th. This phenomenon and the period of appearance seem practically identical with the form among American children.

heavier

Table E corresponds to Table A in heights. The same explanations there made apply here. The usual clothing worn is that of light indoor dress, but of course this varies in different countries and at different seasons of the year. Table F gives the absolute annual increases and Table G the percentage or relative annual increases computed on the same principle as Tables B and C already explained.

THE "AVERAGE" AMERICAN BOY AND GIRL.

Dr. Franz Boas has suggested the feasibility and mathematical propriety of constructing the curve of growth for the

American child by massing the returns from the various localities. Of course the data of a large number of localities are not yet at hand. But the large studies which have been made in Boston, St. Louis, Milwaukee, Worcester, Toronto, and others have justified a beginning.

TABLE H.

Showing the Average American Height Mathematically Calculated by Dr. Franz Boas from the Data of 45,151 Boys and 43,298 Girls in the Cities of Boston, St. Louis, Milwaukee, Worcester, Toronto, and Oakland (Cal.); also the Absolute and the Percentage Annual Increases of same.

Approximate Average Age.	Number of Observations.	BOYS.			Number of Observations.	GIRLS.		
		Average for each Year. Inches.	Absolute Annual Increase. Inches.	Perc'tage Annual Increase. Per cent.		Average for each Year. Inches.	Absolute Annual Increase. Inches.	Perc'tage Annual Increase. Per cent.
5½	1,535	41.7	2.2	5.3	1,260	41.3	2.0	4.8
6½	3,975	43.9	2.1	4.8	3,618	43.3	2.4	5.5
7½	5,379	46.0	2.8	6.1	4,913	45.7	2.0	4.4
8½	5,633	48.8	1.2	2.5	5,289	47.7	2.0	4.2
9½	5,531	50.0	1.9	3.8	5,132	49.7	2.0	4.0
10½	5,151	51.9	1.7	3.3	4,827	51.7	2.1	4.1
11½	4,759	53.6	1.8	3.4	4,507	53.8	2.3	4.3
12½	4,205	55.4	2.1	3.8	4,187	56.1	2.4	4.3
13½	3,573	57.5	2.5	4.3	3,411	58.5	1.9	3.2
14½	2,518	60.0	2.9	4.8	2,537	60.4	1.2	2.0
15½	1,481	62.9	2.0	3.2	1,656	61.6	0.6	1.0
16½	753	64.9	1.6	2.5	1,171	62.2	0.5	0.8
17½	429	66.5	0.9	1.4	790	62.7		
18½	229	67.4						

Tables H and I and Chart III show the growths in height and weight and the annual absolute and proportional increases for what might be termed the "average" American boy and girl. The average in Table I (weight) has been calculated by the mathematician, M. de Perott, upon the follow-

TABLE I.

Showing the Average American Weight Mathematically Calculated from the Data of about 68,000 Children in the Cities of Boston, St. Louis and Milwaukee; also Absolute and Percentage Annual Increases of same.

AGE.	BOYS.			GIRLS.		
	Average for each Age. Pounds.	Absolute Annual Increase. Pounds.	Annual Increase. Per Cent.	Average for each Age. Pounds.	Absolute Annual Increase. Pounds.	Annual Increase. Per Cent.
6½	45.2	....	....	43.4	....	....
7½	49.5	4.3	9.5	47.7	4.3	9.9
8½	54.5	5.0	10.1	52.5	4.8	10.0
9½	59.6	5.1	9.3	57.4	4.9	9.3
10½	65.4	5.8	9.7	62.9	5.5	9.6
11½	70.7	5.3	8.1	69.5	6.6	10.5
12½	76.9	6.2	8.7	78.7	9.2	13.2
13½	84.8	7.9	10.3	88.7	10.0	12.7
14½	95.2	10.4	12.3	98.3	9.6	11.9
15½	107.4	12.2	12.8	106.7	8.4	8.5
16½	121.0	13.6	12.7	112.3	5.6	5.2
17½	....	....	....	115.4	3.1	2.8
18½	....	....	....	114.9	....	....

ing plan: The averages given by Bowditch from 24,500 children of Boston, by Porter from 34,500 children of St. Louis, and by Peckham from 9,600 children of Milwaukee—making nearly 69,000 children all together — have been thrown together, but not averaged directly. At each age the number of children has been massed from these three sources and each of the three averages allowed to influence the average of the whole in proportion to the number of children each city contributes. Thus, for example, suppose at the age of 10 years St. Louis contributes 5,000 children, Boston 4,000 and Milwaukee 1,000 — altogether there would be 10,000 children of that age—the averages of the three cities would therefore influence the final average in the ratio of 5, 4 and 1, on the same principle we use in partnership.

By the generous courtesy of Dr. Franz Boas the writer is able to present the average heights (in Table H) from a still larger area and larger number of children. Dr. Boas, in an article in the Report of the Commissioner of Education (1896-7) which is shortly to appear, has made an average of the returns from six American cities—Boston, St. Louis, Milwaukee, Toronto, Worcester, and Oakland, Cal. The averages which form the basis are those of Drs. Bowditch, Porter, Peckham and West, and are given in Table A, with exception of the Toronto measurements contained in an, as yet, unpublished study by Dr. Boas. The computation, the writer presumes, has been made upon an identical or similar principle to that used by M. de Perott.

INDIVIDUAL VARIATIONS IN HEIGHT AND WEIGHT.

In dealing with averages we must not lose sight of individual variations. The value of averages for practical application to individual children has been a keenly disputed problem ever since Quetelet propounded his theory of types. The problem from a mathematical standpoint will be found elaborately discussed by a variety of different writers.* Individual children of normal rate of growth show a comparatively wide range of deviation at any given period, and also a wide deviation in reaching the crises in the periods of growth.

These variations will be shown by consulting the tables upon Galton's percentile grade system in Porter's "Growth of St. Louis Children," or in the special arrangement of his original data in this form that Bowditch has given in the Twenty-second Annual Report of the Massachusetts Board of Health, 1890.

What may be a still simpler arrangement to show individual variations in height and weight at a given age will be found by Bowditch's original article in his Tables Nos. 4-15. Gilbert in his New Haven and Iowa studies, finds that, on the whole, the variation increases with age, showing a noticeable enlargement during the periods of fastest growth. Previous to 11 years, the variations for boys and girls are about on an equality. In both sexes, Gilbert's curves of mean variation increase quite steadily until the 15th year and then fall off rapidly. This applies for both height and weight. Boys, as a rule, vary more than girls.

From the article by Dr. Franz Boas in the issue of the Report of the Commissioner of Education (1896-7) Tables J and K have been adapted by a reduction of centimeters to inches. The tables are based upon the massing by Dr. Boas of the

*Among recent writers dealing directly with the significance of averages of children's growth, the following references will be found valuable: Boas, *Science*, May 6, 1892, May 20, 1892, Dec. 23, 1892; Porter (^{27, 78}), Bowditch (^{18, 20}), Landsberger, Hall, Peckham, Hansen; Galton, "Natural Inheritance."

TABLE J.

Showing the Frequency of Stature of Boys of Different Ages mathematically Calculated by Dr. Franz Boas from Data Furnished by the Measurement of 45,151 Boys in the Cities of Boston, St. Louis, Milwaukee, Worcester, Toronto and Oakland (Cal.). (Adapted from centimeters to inches.)

Age in Years.	5.589	6.536	7.511	8.504	9.496	10.494	11.492	12.489	13.481	14.467	15.454	16.445	17.453	18.424
Cm.	Inches.													
91	35.83	0.4												
93	36.61	0.6												
95	37.30	1.7	0.1											
97	38.19	3.5	0.4											
99	38.98	6.7	0.7											
101	39.76	10.7	2.2	0.2	0.1	0.1								
103	40.55	15.3	4.9	0.8	0.1	0.1								
105	41.34	16.9	9.0	2.0	0.4	0.1								
107	42.13	13.7	12.2	3.3	0.5	0.1								
109	42.91	13.3	15.5	6.2	1.3	0.1	0.1	0.1						
111	43.70	9.1	15.8	11.1	2.5	0.3	0.1	0.1						
113	44.49	4.3	13.5	13.0	4.6	0.8	0.1	0.1						
115	45.28	2.3	10.9	14.8	7.7	1.6	0.4	0.1						
117	46.06	0.9	6.9	14.7	11.3	4.1	0.7	0.2						
119	46.85	0.5	4.1	12.5	14.3	6.9	1.8	0.2	0.1	0.1				
121	47.64	0.2	2.2	9.1	15.0	10.3	3.7	0.7	0.2	0.1	0.1			
123	48.43	0.9	5.9	3.5	12.9	6.0	1.8	0.5	0.2	0.1	0.1			
125	49.21	0.3	3.4	10.5	13.8	8.8	3.1	0.8	0.2	0.1				
127	50.00	0.3	11.8	7.9	13.9	11.1	6.0	1.9	0.7	0.2				
129	50.79	0.1	0.7	4.8	12.0	12.8	8.5	3.5	1.0	0.2				
131	51.57		0.3	2.7	9.2	12.7	9.6	5.3	1.6	0.4				
133	52.37		0.2	1.5	6.3	12.3	12.0	7.7	2.8	0.8	0.1			
135	53.15			0.7	3.5	10.5	13.5	10.5	4.8	1.2	0.3			
137	53.94			0.4	2.0	7.8	11.9	10.8	6.1	2.5	0.6	0.1	0.2	
139	44.72			0.1	1.0	5.0	10.4	12.5	8.8	3.6	1.5	0.4		
141	55.51			0.1	0.4	3.1	8.6	11.3	10.1	5.2	2.2	0.4		
143	56.30			0.3	1.8	5.3	9.9	10.8	5.6	2.2	0.7			
145	57.09			0.1	0.7	3.2	7.7	10.5	8.0	3.2	0.7	0.3		
147	57.87			0.1	0.4	2.1	5.9	9.3	9.1	4.2	0.8	0.3		
149	58.66				0.3	1.2	4.3	8.6	10.0	6.1	2.3	0.3	0.4	
151	59.45				0.1	0.7	2.7	6.3	8.2	7.3	2.8	0.7	0.4	
153	60.24					0.3	1.8	5.3	8.8	7.6	2.7	1.4	0.9	
155	61.02					0.1	1.2	4.9	8.3	7.8	4.9	1.6	2.2	
157	61.81					0.1	0.6	3.1	6.2	8.2	5.8	3.9	1.8	
159	62.60					0.1	0.5	1.7	5.7	8.6	8.0	5.4	2.6	
161	63.39						0.2	1.1	4.7	8.1	8.4	5.8	3.9	
163	64.17						0.1	0.7	3.7	6.6	10.5	8.9	9.2	
165	64.96							0.4	2.4	6.9	10.1	11.4	9.2	
167	65.75							0.2	1.5	6.0	10.2	10.3	10.5	
169	66.54							0.3	1.4	4.7	10.5	10.5	10.9	
171	67.32							0.1	0.9	3.3	8.6	9.6	13.5	
173	68.11								0.5	2.0	4.5	9.3	9.6	
175	68.89								0.2	1.1	3.0	7.2	8.3	
177	69.68								0.2	0.6	2.7	5.1	5.2	
179	70.47								0.1	0.4	1.2	4.3	4.8	
181	71.26									0.1	0.5	2.3	6.1	
183	72.05										0.1	0.5		
185	72.83										0.1	0.5		
187	73.62											0.4		
189	74.41											0.3		
No. of Boys.	1,535	3,975	5,379	5,633	5,531	5,151	4,759	4,205	3,573	2,518	1,481	753	429	229
Corrected Mean Variation (cm.)	4.80	4.92	5.22	5.53	5.66	5.90	6.32	6.80	7.71	8.66	8.87	7.75	7.23	6.74

TABLE K.

Showing the Frequency of Stature of Girls of Different Ages Mathematically Calculated by Dr. Franz Boas from the Data Furnished by the Measurement of 43,298 Girls in the Cities of Boston, St. Louis, Milwaukee, Worcester, Toronto and Oakland (Cal.). (Adapted from centimeters to inches.)

Age in Years.	5.611	6.545	7.513	8.501	9.497	10.495	11.494	12.490	13.479	14.471	15.466	16.473	17.466		
Cm.	Inches.														
91	35.83	0.1	0.1												
93	36.61	0.9	0.1												
95	37.40	2.2	0.1												
97	38.19	4.6	0.6												
99	38.98	9.4	1.5	0.1											
101	39.76	12.3	3.5	0.3	0.1	0.1									
103	40.55	17.1	6.7	1.3	0.1	0.1									
105	41.34	16.8	10.2	2.5	0.3	0.1									
107	42.13	13.9	13.9	4.3	0.6	0.3	0.1								
109	42.91	11.1	17.1	8.3	2.0	0.1	0.1								
111	43.70	6.0	14.8	11.4	3.8	0.4	0.1								
113	44.49	2.9	11.3	13.0	6.0	1.2	0.2	0.1	0.1						
115	45.28	1.9	9.1	15.4	9.3	2.8	0.5	0.2	0.1						
117	46.06	0.4	6.0	13.3	11.8	4.7	1.1	0.2	0.1	0.1					
119	46.85	0.1	2.7	12.0	14.4	7.9	2.4	0.4	0.1	0.1					
121	47.64	0.2	1.3	9.0	14.2	11.0	4.3	1.2	0.3	0.1					
123	48.43	0.5	4.5	12.5	13.2	6.3	1.9	0.4	0.1						
125	49.21	0.2	2.8	9.9	14.2	9.5	3.2	0.7	0.1	0.1					
127	50.00	0.1	1.1	6.9	14.0	11.2	5.4	1.4	0.2	0.1					
129	50.79	0.1	0.5	2.4	11.1	13.2	7.9	2.6	0.4	0.1					
131	51.57		0.2	2.1	7.9	13.0	10.1	3.9	0.8	0.2					
133	52.37		0.1	0.9	4.7	11.7	11.7	5.6	1.3	0.4					
135	53.15			0.4	3.0	9.2	11.7	7.5	2.6	0.6					
137	53.94			0.3	1.7	6.7	10.4	9.1	4.4	0.9	0.2				
139	54.72			0.1	1.0	4.4	10.4	10.4	5.6	1.7	0.7	0.2			
141	55.51				0.3	2.8	8.3	11.4	6.5	2.6	0.7	0.2	0.1		
143	56.30				0.1	1.7	6.0	10.3	7.8	3.5	1.5	0.8	0.3		
145	57.09					0.1	0.7	4.2	9.0	10.8	5.6	2.6	2.0	1.0	
147	57.87						0.4	2.6	7.2	9.3	7.0	3.8	2.6	2.4	
149	58.66						0.2	2.1	6.2	11.2	10.2	7.8	5.4	4.4	
151	59.45						0.1	1.0	4.8	10.5	12.4	10.2	8.2	6.7	
153	60.24							0.4	3.4	8.4	12.8	12.1	11.0	8.4	
155	61.02							0.3	2.4	7.6	13.4	15.3	12.9	10.8	
157	61.81							0.1	0.2	1.6	4.9	9.3	11.8	12.7	16.1
159	62.60								0.1	0.8	3.4	7.4	11.2	13.8	13.5
161	63.39								0.3	2.0	5.1	8.9	11.3	13.8	
163	64.17								0.1	1.0	3.0	5.9	7.3	7.1	
165	64.96								0.1	0.4	1.9	3.5	5.8	7.1	
167	65.75								0.1	0.2	0.8	2.2	2.9	3.5	
169	66.54									0.1	0.5	0.7	1.4	2.4	
171	67.32									0.1	0.2	0.5	1.2	1.1	
173	68.11										0.2	0.2	0.2	0.5	
175	68.89											0.2	0.1	0.8	
177	69.68														
179	70.47														
No. of Girls.	1,260	3,618	4,913	5,239	5,132	4,827	4,507	4,187	3,411	2,537	1,656	1,171	790		
Corrected Mean Variation (cm.).	4.64	5.97	5.25	5.58	5.73	6.18	6.83	7.57	7.37	6.69	5.96	5.79	5.75		

data on height in the six American cities—Boston, St. Louis, Milwaukee, Worcester, Toronto and Oakland. The figures in the body of the tables give the percentages of boys or girls at the ages (shown at the top of each column) who are of the heights indicated in the column at the left. An addition has been made in the original table of Dr. Boas by expressing the heights in inches as well as in centimeters. Each given height is meant to include two centimeters; thus in the first line the percentages are for the heights 91 cm. to 92.99 cm., the second line for the heights 93 to 94.99, and so on. Thus, for example, the column for boys of 5.589 years shows that .4 per cent. of the 1,535 boys between 5 and 6 years measure 35.83 to 36.61 inches in height, .6 per cent. measure 36.61 to 37.40 inches, and so on down to the smallest boys, .2 per cent. of whom measure 47.64 to 48.43 inches. These tables, therefore, give a ready reference for determining the variations of individuals.

TABLE D.

Showing the Individual Yearly Height and Absolute Annual Increases of Dr. Wiener's Four Sons from Birth to 25 Years. (Centimeters.)

	First Born.	Second Born.	Third Born.	Fourth Born. Different Mother.	ANNUAL ABSOLUTE INCREASE.			
					First Born.	Second Born.	Third Born.	Fourth Born.
Birth	54.0	46.0	52.4	55.0				
1	71.7	70.8	74.2	74.0	17.7	24.8	21.8	19.0
2	84.6	83.8	86.4	85.9	12.9	13.0	12.2	11.9
3	93.1	92.3	94.2	95.3	8.5	8.5	7.8	9.4
4	100.1	100.5	101.9	104.2	7.0	8.2	7.7	8.9
5	106.4	108.0	108.0	111.2	6.3	7.5	6.1	6.9
6	113.7	114.0	114.5	116.7	7.3	6.0	6.5	5.6
7	119.8	119.6	120.4	124.0	6.1	5.6	5.9	7.3
8	125.2	125.0	125.7	130.4	5.4	5.4	5.3	6.4
9	130.5	130.3	131.1	136.3	5.3	5.3	5.4	5.9
10	134.8	134.8	136.7	141.4	4.3	4.5	5.6	5.1
11	140.7	140.6	142.2	146.0	5.9	5.8	5.5	4.6
12	146.2	146.3	145.2	152.9	5.5	5.7	3.0	6.9
13	154.7	153.2	151.9	162.8	8.5	6.9	6.7	9.9
14	164.2	161.4	157.1	168.2	9.5	8.2	5.2	5.4
15	169.0	169.1	166.5	175.0	4.8	7.7	9.4	6.8
16	171.4	173.3	172.2	178.3	2.4	4.2	5.7	3.3
17	172.7	175.1	175.7	179.8	1.3	1.8	3.5	1.5
18	172.8	176.3	176.6	180.3	0.1	1.2	0.9	0.5
19	172.9	176.5	177.5	180.7	0.1	0.2	0.9	0.4
20	172.9	176.6	177.8	180.9	0.0	0.1	0.3	0.2
25	173.2	176.7	178.2		0.3	0.02		

As an interesting comparison with general averages computed from masses of children, the above table of the

growth in height of four individuals, from birth to manhood, are taken from a study by Dr. Christian Wiener of Karlsruhe.

They are the measurements of the four sons of Dr. Wiener taken by himself.¹ The fourth-born son is by a different mother than the first three. The second wife was 5.1 centimeters taller than the first, and her child was born in her 36th year, while the first three sons were born in the 22d, 23d and 28th years respectively of their mother's life. The original measurements were taken not always exactly upon the birthdays, and the figures given, in order to make comparison available, have been computed to exact birthdays. The differences in time were generally so slight that the value of the figures is in no way affected.

The facts of these individual variations raise the important question whether or not the aim of training should be to make the child grow to specific dimensions. May it not be that each organism has ordained for it, we might say, by determined hereditary factors a particular size? This, however, is not the underlying principle of existing theories and practices in physical culture. The work of physical culture, as a rule, proceeds upon the assumption that there is an average size, and it should be our aim to approximate the average size or average proportion. In our gymnasiums our growing young people are measured. If the individual exceeds or falls short from the standard, specific exercises are given to develop this spot, to reduce that, and so forth. May, after all, this be all wrong? As will be later suggested by phenomena of growth, there is evidence that every organism seems to have a particular size, which it struggles desperately to attain. If we wish to speculate with Weismann, we may conceive that in the fertilized egg, the determinants have already, by hereditary forces, decided just the size and just the proportion each organism specifically ought to have. This decision is reached by natural selection within the egg. If in the growing period, by virtue of poor nutrition, disease, lack of exercise, or any other accident, any part of this organism fails to reach predetermined proportions, then there will be disharmony and lack of proper proportion. In so far will there be interference, for the parts will not exactly fit. Up to this point, we find ourselves in agreement with the ruling principle of physical development. But, upon the assumption of a particular size, is the physician or any one to determine by any tests of measurements what part should be developed or what reduced? The particular may vary from the "average" or the mean, and yet be entirely normal for that

¹Other tables of individual growth, in weight as well as in height, will be found given by Camerer.(²³)

individual. By artificial development, may we not do for the individual just what disease or mal-nutrition is supposed to do—to destroy the particular proportion? This view is not put forth as a theory, but in the light of further treatment as an alternative view deserving consideration.

DAILY, WEEKLY AND SEASONAL RHYTHMS OF GROWTH.

We have considered the increases in physical structure for the whole growing period, and have seen that the rate is by no means continuous and constant; but is broken up into a number of rhythms, as it were, rapid periods and then slower periods. It remains to consider the rate during a single year. Here, again, the view until very recent years has been the accepted notion that for this period, at least, the rate was constant. It was only a few years ago that Wretlind in Denmark weighed children before and after the three months' vacation, which occurred from July to September, and finding that the rate of increase during this period was more rapid than during the other nine months of the year, jumped to the conclusion that the injurious influences of attendance at school accounted for it. The chief contribution to this phase of the problem has been by R. Malling-Hansen, director of the Deaf and Dumb Institute at Copenhagen. He has weighed and measured his pupils, and in his three contributions on the subject has presented a mass of detailed information and some very suggestive causal theories. He finds three general seasonal periods during the year for height and the same number for weight; weekly variations, daily variations, and also a slighter rhythm, seemingly dependent upon the solar month.

The pupils of the school, 130 in number, were between the ages of 9 and 17. Nearly all of his tables in *Perioden im Gewicht der Kinder und in der Sonnenwärme*, are based upon measurements and weighings of about 70 boys, weighed from May, 1882, to February, 1886, and measured from February, 1884, to February, 1886; the children were weighed four times a day, with the exception of the vacation time from the middle of July to the end of August. The pupils were weighed in groups of sixteen to eighteen, and the heights given are similarly those of groups. His data therefore show nothing regarding individuals.

The most important of Malling-Hansen's contributions is that concerning seasonal growths. From his careful measurements of about 70 boys for two years, and weighings for three years, he concludes (⁶⁴): "The weight of a 9 to 15 year-old boy has three periods of growth during the year—a maximal, a middle, and a minimal. The maximal period begins

(⁶⁴) P. 29.

in August and concludes in the middle of December, lasting, therefore, four and one-half months. The middle period extends from the middle of December to the end of April, four and one-half months. The minimal period extends from the end of April to the end of July, therefore three months. During the maximal period the rate of increase in weight is three times as great as in the middle period. Almost the whole weight gained in the middle period is lost during the minimal period."

Respecting height he finds similar rhythms of growth, a maximal, a middle and a minimal period. "The minimal period begins in August and lasts until the middle of November, three and one-half months. The middle period reaches from the end of November till the end of March, about four months. The maximal period extends from the end of March until the middle of August, about four and one-half months. The daily rate of growth is two and one-half times as great, and that of the middle period twice as great, as that of the minimal period."

Approximately, it is to be observed, the period of maximal growth in weight, the autumn, is the period of minimal growth of height; and in spring and summer, while the body is growing most rapidly in height, it is actually losing in weight.

Malling-Hansen finds that children increase in weight and decrease in height by day, and increase in height and decrease in weight by night. In boys of 13 to 16 years, this increase or decrease can be as much as 10 millimeters, and a loss of .57 kilograms in weight during the night. The weekly variations are dependent upon local conditions, to a large extent due to variation or appetite.

Malling-Hansen has also given a body of facts and a very suggestive theory regarding the influence of temperature upon growth in weight and probably upon height. He finds that whenever there is an increase in atmospheric heat, there is also an increase in weight of the children weighed, and when the atmospheric temperature sinks, the rate of growth sinks. The correspondence is not, however, proportional in amount. At great labor and length, he gives tables of the temperature in various parts of the world for identical periods, and finds slight rhythms in the rise and fall of the atmospheric temperature; and thereupon offers as a cause an elaborate theory that the rotation of the sun upon its axis, thereby presenting different portions of its surface towards the earth, some of which radiate more heat than others, affects the growth in the animate world rhythmically. The periods are of about 25 or 26 days, within which are briefer periods of

maximal and minimal radiations of growth energy. He claims to show these effects, not only in growth of children, but in other physiological phenomena of adults, especially in women. His charts (⁶⁴), explaining the theory, give details strikingly forcible in support of his theory.

Camerer* weighed a youth of 17 years, a boy of 8 years and an infant of six weeks several times during twenty-four hours, and also carefully weighed the food and excrement. He finds fluctuations in the youth of about one kilogram during the day; in the boy about .65 kilogram, and in the infant about .2 kilogram. The curves are strikingly alike in the three cases, rising in rhythms with slighter falling fluctuations from morning till evening; during the night the gain of the day is lost. Camerer corroborates Malling-Hansen also in the facts of the seasonal fluctuations, but declines to accept the meteorological explanation offered by the latter.

Dr. M. Vahl, of the school for homeless girls at Jagerpris in Denmark, weighed the pupils twice a year, on April 1 and October 1, from 1874 to 1883 inclusive. His results show that the increase in weight in the summer half year is about 33 per cent. greater than during the winter half year.

Vierordt (¹⁹³) offers some corroborative data in a table constructed from weights of children in first year, contributed by Fleischmann, Ahlfeld, Hesse, and Holmer. Distinct rhythms of growth in cycles approximating a week are shown. Fleischmann comments as follows: "If one weighs children weekly, he will be surprised at peculiar variations of increase. There is a period of rapid growth followed by a weaker period. This change is striking, and repeats itself weekly or half-weekly, so that in quite healthy children there is a continual fluctuation. What forces are operating are to me undiscoverable."

Combe in Lusanne studied the question whether or not the season of the year in which children are born affects their subsequent rates of growth. His tables follow the growth in height of children, segregated according to the month of the year in which they were born. He concludes that the rate (*i. e.*, determined by annual increments) is not affected, but that the height at any given age is very materially influenced. Boys born from September to February are shorter than those born from March to August; while in the case of girls, December to May inclusive are the unfavorable

* An earlier publication by this author, "*Der Stoffwechsel eines Kind in ersten Lebensjahre*" (*Zts. f. Biologie*, 1878) gives data on daily fluctuations more fully.

(⁹³) P. 247.

months for birth. The difference of the averages is slight, but nevertheless perceptible. This conclusion which Combe finds is interesting in connection with Malling-Hansen's principle of seasonal growths.

FACTORS OF VARIATION IN GROWTH.

Some of the factors which have been put forth as influencing variations in growth, aside from those of age and sex, have been race, social and nutritional environment, occupation, climate, exercise and density of population. That some children are taller and heavier than other classes, either in the same or different localities, has been demonstrated; but exactly to what factors these variations are to be definitely attributed is a matter as yet far from conclusive solution. The problem in whatever form it occurs is always a highly complex one, making it difficult to segregate causes clearly.

Nutrition.—The view that growth in some degree is determined by nurturing environment is an old one, and existed before any careful and general statistics had been made. Villerme in 1829 concluded that stature is greater and the growth sooner completed, all other things being equal, in proportion as the country is richer and the comforts of the inhabitants more general. Quetelet later assumes and emphasizes this view and Cowell (^{†26}) in England, from an investigation in 1833 of 1,062 factory children, and 228 others in more favored conditions, draws a similar conclusion. Boudin in France, from his studies of height and weight of different races, chiefly from military statistics, concluded that stature is to a great extent "independent of comfort and misery, and is on the contrary closely connected with race." Donaldson (^{†29}), from the data in Roberts' Anthropometry, thinks that "the environment has more influence upon males than upon females." Porter (^{†78}) in St. Louis is inclined to conclude that "a wide difference in social station and material prosperity may exist, without much influencing the growth up to the prepubertal acceleration," and Key (^{†59}) goes so far as to say from comparison of curves of development in America, England and Sweden that "the weak period of development before puberty is lengthened for the poorer children to their cost. . . . The period of accelerated development is made later for them, but once commenced passes more quickly, and what is very surprising is completed generally in the same year as that of well-to-do children. The whole period is shorter for poor children, but there is a

(²⁶) Cowell's table will be found in Bowditch's "Growth of Children," p. 78.

(²⁹) P. 59.

(⁷⁸) P. 309.

(⁵⁹) P. 87.

stronger increase during the last year of the period." Roberts, from his comparison of data upon the favored and the artisan classes of England, says, "With the accession of puberty there is an increased rate of growth in the non-laboring classes, and an entire cessation of it at the age of 19 or 20 years; while in the artisan classes the growth is more uniform and extends to about the 23d year."

But such conclusions as these, upon a basis of actual measurements thus far made, are only valuable as suggestions. The conditions of actual data are yet far from absolutely justifying such sharply defined results.

General anthropometrical measurements upon adults with reference to the influences of race and nutrition have received important study by Drs. J. H. Baxter and B. A. Gould. Both find that American recruits are taller than those of European countries, and that natives of European countries who enlisted in American armies are taller than those who attained their growth in the lands of their nativity. Dr. Gould makes a forcible argument from statistics that this greater growth is attributable to the greater comfort of American life. Dr. Baxter, however, is inclined to minimize the influence of comfort and plenty.

In America the chief attempt to solve the problem of the influence of nutritional conditions upon growing children has been made by Dr. Bowditch of Boston. In the Eighth Annual Report, he deals with the problem more generally, but the Tenth Report is devoted chiefly to the factors of race and nutrition. In the Eighth Report, he gives a table of heights and weights of Boston boys attending certain schools, indicating the probability "that these pupils represent a class in

AGE.	HEIGHT (inches).		WEIGHT (lbs.).	
	Favored.	General.	Favored.	General.
10	53.51	51.68	70.6	65.36
11	54.96	53.33	75.3	70.18
12	56.78	55.11	85.9	76.92
13	59.60	57.21	94.4	84.84
14	61.51	59.88	99.9	94.91
15	64.20	62.36	116.6	107.10
16	65.83	65.00	125.8	121.01
17	67.44	66.16	135.2	127.49
18	67.44	66.66	138.2	132.55

the community corresponding sufficiently well in social conditions to that class in England which sends children to the public schools and universities." This table is given above

under heading of "Favored." Compared with the entries in these columns are the entries from the general averages of the entire Boston school population. It is clear at a glance that, at any given age, the boys from the favored classes are both heavier and taller than those of the general school population.

Bowditch constructs a table and curve of heights in relation to weight, and concludes from English data of Roberts that it would seem that "deprivation of the comforts of life has a greater tendency to diminish stature than the weight of a growing child." Bowditch's general tables indicate that children in Boston of American parentage are both taller and heavier, at a given age, than children of foreign parentage. He draws attention to the fact that the foreign population comes, as a rule, from the poorer European classes, and he concludes: "It is reasonable to assume that the superior size of children of American parentage in the Boston schools is due in part to the greater comfort in which they live and grow up, and in part to other conditions, which may be described collectively as differences of race and stock."

In the Tenth Report, Dr. Bowditch groups, in tables and curves, the children by sex and ages from 5 to 18 years, into the rubries of those whose parents are laboring, and those whose parents are non-laboring, and also takes the two races represented—American and Irish—and groups each of these separately into those whose parents are non-laboring and laboring. His tables show, on the whole, though differences are usually small, that the children of the poorer classes, at a given age, are smaller than those of the classes which enjoy presumably better nutrition, and Bowditch finds it "safe to conclude that the importance of mode of life as a factor in determining the size of growing children in this community (Boston) is at least equal to, and possibly even greater, than that of race."

One of the most general investigations bearing upon the effects of favorable and unfavorable influences is that of Roberts in England, detailed in his *Anthropometry*. He gives tables showing height, weight and chest girths of 7,709 males between the ages of 10 and 30 years, representing the most favored population of England—public school boys, military cadets, medical and university students. To be compared with these are tables showing the same facts from 13,931 males, between the ages of 4 and 50 years, belonging to the artisan class of England. Roberts concludes that the prepubertal growth begins in the favored classes a year or two earlier than in the laboring classes, and that there is "both a higher mean height and a wider range from tallest to shortest

among favored classes. . . . During the periods over which the observations extend, the most favored class has a mean height of about two inches greater than that of the industrial classes, but it is probable that if the observations were extended to the time of birth, they would gradually approximate." A second series of tables constitutes comparisons between boys and men from the professional, commercial, industrial classes, idiots and imbeciles, and Americans. The comparisons are generally in accord with those above indicated. The favored classes at any given age are very perceptibly heavier and taller on the average than those of the less favored classes.

The Anthropometric Committee of England, in its report (³⁷) of 1883, presents data of height from 37,374 males and 1,616 females; and of weight from 33,043 males and 4,685 females of England, from birth to 70 years of age. By tables these data are segregated into four classes: professional, commercial, laboring (country), and town artisans. The data for the females when classified are of little value, owing to smallness of the numbers considered. The facts, however, generally indicate the conclusions that at any given age the professional classes are both taller and heavier than the less favored classes. Of special interest in this matter is a table of the growth in height and weight of 1,273 boys and 601 girls under 16 years of age, inmates of the Swinton Industrial School of England. They therefore represent the most unfavorable conditions of life and heredity. Compared with boys of Roberts' most favored class of England, these industrial school boys are, at 10 years of age, 3.31 inches shorter and 10.64 pounds lighter; at 14, 6.65 inches shorter and 21.85 pounds lighter.

Geissler and Uhlitsche compare the heights of children of the Freiburg Burgerschule with those of the children of the peasant classes in the surrounding country. The former live under relatively more favored conditions. For the ages given, the Burgerschule children are distinctively taller. The following table shows the differences in favor of the Burgerschule pupils at each age in centimeters:

Age,	6½	7	8	9	10	11	12	13
Boys,	2.4	2.7	2.3	5.1	2.7	2.3	3.8	4.7
Girls,	3.9	3.6	2.8	3.8	4.5	3.9	3.1	5.1

The compilers compare the heights of each class with the general average obtained, and feel justified in concluding, "The children of the peasant families are on the average, without exception, smaller and the children of the Burgerschule larger than the average of the whole. This fact stands

even when the corrections of probable error are applied. One may therefore perhaps assume that the different social conditions under which children live influence essentially their physical development."

Geissler in Gohlis-Leipzig separates the data of height and weight of children of a Bürgerschule paying 18 marks from another paying 9 marks—a fact which the compiler considers basis for distinguishing the richer from the poorer classes. He does not give the tables, but summarizes his findings as follows: "The differences in height for boys of similar ages vary in favor of the richer class from 0.7 to 4.0 centimeters, and in weight between 7.3 and 4.7 pounds (German); with girls from 1.7 to 4.1 centimeters in height, and in weight between 1.6 and 4.6 pounds (German).

The Danish Commission (⁵¹) gave the subject of social and nutritive conditions some attention. Hertel (⁵³) gives a table for boys and girls of 11, 12, 13 and 14 years. It shows that the boys of the Gymnasia, presumably representing the more favored classes, are slightly taller and heavier than the boys of the Real and Bürger schools, and the boys of the Real schools are taller and heavier as a rule than those of the Burger schools. These differences, varying up to an inch or two in height and to a pound in weight, are more distinct in earlier ages than at 14 years. In the Volkschulen, however, there is no essential difference between the boys who attend schools requiring tuition and those attending free schools, but the sons of the "Baner" class (small country farmers) are taller and slightly heavier than the sons of "Arbeitern" (artisans). Among the girls of the ages as given, those in the higher girls' schools (the more favored class) are an inch, or less, taller; and heavier from no difference at 11 years to about 3 pounds at 14 years. In the girls of the Volkssehulen, those who pay are heavier and taller (the difference increasing with age) than those who do not, and the daughters of the "Baner" class have a slight advantage over the children of the "Arbeitern."

Erismann, quoting investigations of Michailoff upon comparisons of physical development of children in the city schools of Moscow, of village schools, and factory children, shows superiority in height of the Moscow boys in school over the factory boys as follows (in centimeters):

Age,	9	10	11	12	13	14	15	16	17
Boys,	.4	4.6	5.7	5.7	7.7	9.0	9.7	8.7	5.4

But, strangely, the factory girl exceeds the school girl in height until the age of 14, but at this age and later falls very significantly behind. The height of the two classes is here given in centimeters.

Age.	School Girls.	Factory Girls.
7	111.6	.....
8	116.4	118.8
9	119.6	123.6
10	125.0	129.5
11	129.7	131.0
12	132.9	135.5
13	138.3	139.9
14	145.8	143.4
15	146.4	148.2
16	150.3	151.0
17	.....	152.4
18	.....	152.8

The heights of factory boys at 8 years (based on less than 100 cases) are 2.3 centimeters greater than those of the school boys. The same general relation appears in the weights. Up to 11 years the school boys are shorter than the factory boys (the number of the latter is less than 100 for the years of 10 and 11) until 11 years, but after that age the school boys are taller by the following differences (in centimeters):

Age,	11	12	13	14	15	16	17	18
Boys,	1.12	2.21	6.06	5.79	6.70	8.5	7.8	5.4

The data for comparison of school girls with factory girls are not given; but city school girls, as well as boys, very significantly exceed village school girls and boys from 8 years through the 13th year (as far as data are given for the village children). In breast circumference the factory children, both boys and girls, slightly exceed the city school children at 8 to 12 years inclusive (data prior to 8 years not given), but after 12 years until 20 they are very slightly smaller.

Key (⁵⁸) compares children attending the preparatory and middle schools of Stockholm with those of the Volksschulen, the former representing the more favored classes and the latter the poorer classes. The differences in favor of the better nourished children (indicated by the + sign) are given as follows (— indicates a difference in favor of the poorer classes):

HEIGHT.

Age,	7	8	9	10	11	12	13	14	15
Boys (cm.),	+4	+4	+6	+4	+2	+3	+2	+5	+4
Girls (cm.),	-1	+2	+2	+2	+3	+3	+2	+2	+3

WEIGHT.

Boys (kg.),	+0.3	+0.4	+3.0	+1.6	-1.4	+1.5	+1.6	+5.3
Girls (kg.),	-0.6	+1.8	+1.4	+1.4	+1.4	+2.0	+1.9	+3.5 +2.9

Pagliani compares the weights of girls in a private school near Turin, Italy, with those of charity girls in the city. At 15 years the charity girls are 37.1 kilograms in weight and the school girls 45.6 kg. Stature also shows a difference against the charity girls.

The data as detailed seem clearly to justify the conclusion that, at any specified age (data are absent for ages under 6 or 7 years), children of both sexes, who live in conditions of more favorable nurture, are, on the average, both taller and heavier than those of less favored nutritional conditions. Our data upon this subject are extremely weak for ages under 10 years, and clearly many more numerous and more careful studies are needed before the principle involved will be cleared. But the question as to the *rate* of growth relatively in the favored and unfavored classes places our data under a new aspect. It is of importance to know at what period of growth favorable or unfavorable environment most affects growth as shown by the rate. It is evident that while the children in unfavored conditions may at any given age be actually smaller than those of the favored classes, yet they may make, nevertheless, a more rapid rate of growth. This will be clear by an example. Bowditch's girls of Irish parentage in Boston from the non-laboring classes are in height at 6 years 111.1 cm., while those of the laboring class average but 109.1 cm.; at 10 years the non-laboring class measures 131.7, the laboring 129.7; at 17 years the non-laboring are 156.2 cm., the laboring 155.7. The girls from the non-laboring classes exceed the girls from the laboring classes by 2 cm. at 6 years, 2 cm. at 10 years, .5 cm. at 17, and at every age, indeed, the table shows they are taller. Yet if we subtract the height of each class at 6 from the height at 10, we get in each case 20.6 cm., showing that for these four years the two classes made the same actual increment of growth. The apparent difference between them is due to the fact that at 6 years the girls from the laboring classes already were smaller. Now, if in the same way we subtract the height of each class at 10 years from their heights at 17, we find that in this period of seven years the non-laboring classes have grown 24.5 cm., while those of the laboring classes have grown 26 cm. In other words, while at each age the unfavored class is smaller, yet they have actually grown 1.5 cm. more than the favored class. Their rate has been more rapid. The differences at the different years is due to the fact that the unfavored class were smaller to begin with, that is, at 10 or 6 years. Reducing this rate to percentage form, we may say that the girls from the non-laboring classes grew 18.5 per cent. of their height at 6 years in the four ensuing years,

while those of the laboring class grew 18.8 of their average height at 6. From 10 to 17 years the favored class grew 18.6 per cent. of their height at 10 years, and the unfavored class grew 20 per cent. of their height at 10. Did all data bear out this ratio, we should conclude that children under poor nutritive conditions grow faster from 6 to 17 years than children from the favored class, and that the conditions which poor nutrition affect must lie in the early years of childhood or embryonic life. Indeed, on the whole, the data will point to a possible conclusion of this kind. If, now, we take the same data that have been reviewed and calculate the percentage rate of growth, we are not able to conclude so definitely that the child of favorable conditions always grows faster than the child of unfavorable conditions. There seems to be very little difference in the two rates on a whole, and the children of the unfavored classes in height exceed those of the favored classes in percentage rate more than the reverse. In weight increases, however, the coincidence is pretty clear that poor nutrition steadily lessens the rate of growth. As a rule the results are based upon such small numbers that the figures are not of assuring value. We may take Bowditch's figures from the Tenth Report for an illustration, and the following tables are calculated from the different classes represented, both as to height and weight :

TABLE J.

Showing the Rates of Growth of Favored and Unfavored Classes, Calculated from Bowditch of Boston.

BOYS OF BOSTON.	Height at 6 years. cm.	Height at 10 Years. cm.	Height at 17 Years. cm.	Absolute Increase. 6-10 Yrs. cm.	Absolute Increase. 10-17 Yrs. cm.	Per Cent. Increase. 6-10 Yrs.	Per Cent. Increase. 10-17 Yrs.
American— Non-laboring Class,	113.0	133.0	168.7	20.0	35.7	17.6	26.8
Laboring Class,	111.5	132.0	167.6	20.5	35.6	18.4	26.9
Irish— Non-laboring Class,	110.8	131.5	165.1	20.7	33.6	18.7	25.5
Laboring Class,	111.2	131.0	168.5	19.8	37.5	17.8	28.6
Irrespective of Nation- ality—Non-laboring,	112.1	132.5	168.1	20.4	35.6	18.2	24.6
Laboring,	111.2	131.0	167.1	19.8	36.1	17.8	27.5

GIRLS OF BOSTON.	Height at 6 Years. cm.	Height at 10 Years. cm.	Height at 17 Years. cm.	Absolute Increase. 6-10 Yrs. cm.	Absolute Increase. 10-17 Yrs. cm.	Per Cent. Increase. 6-10 Yrs.	Per Cent. Increase. 10-17 Yrs.
American— Non-laboring Class,	113.4	131.8	157.6	18.4	25.8	16.2	19.6
	110.4	131.5	157.5	21.1	26.0	19.2	19.8
Irish— Non-laboring Class,	111.1	131.7	156.2	20.6	24.5	18.5	18.6
	109.9	129.7	155.7	19.8	26.0	18.0	20.0
Irrespective of Nation- ality—Non-laboring,	112.1	131.3	157.3	19.1	26.0	17.0	19.8
	109.9	130.3	157.4	20.4	27.1	18.5	20.8

BOYS OF BOSTON.	Weight at 6 Years. lbs.	Weight at 10 Years. lbs.	Weight at 17 Years. lbs.	Absolute Increase. 6-10 Yrs. lbs.	Absolute Increase. 10-17 Yrs. lbs.	Per Cent. Increase. 6-10 Yrs.	Per Cent. Increase. 10-17 Yrs.
American— Non-laboring Class,	45.61	66.05	129.2	20.44	63.15	44.8	95.6
	44.81	66.38	128.6	21.57	62.22	48.1	93.8
Irish— Non-laboring Class,	45.33	67.37	119.15	22.04	51.78	48.7	76.9
	45.25	64.70	124.5	19.45	59.85	42.9	92.5
Irrespective of Nation- ality—Non-laboring,	45.50	65.31	128.23	19.81	62.92	43.5	96.3
	45.06	64.89	125.28	19.83	60.40	43.9	93.0

GIRLS OF BOSTON.							
American— Non-laboring Class,	44.43	64.78	116.3	20.35	51.52	45.8	79.5
	43.47	63.47	115.14	20.00	51.67	46.0	81.4
Irish— Non-laboring Class,	44.05	63.64	110.75	19.59	47.11	44.5	74.7
	43.15	61.35	121.8	18.20	60.45	42.2	98.5
Irrespective of Nation- ality—Non-laboring,	44.14	63.76	115.15	19.62	51.39	44.4	80.6
	43.13	61.98	115.72	18.85	53.74	43.7	86.7

It is evident that the data give no certain evidence of an increase in rate with better nutrition, though at any given age there is a difference. In the majority of cases, where there is any material difference in rate indicated, the children of poorer nutrition grow faster.

Roberts' comparison between the favored and unfavored classes of England at any given age indicate very significant differences to the advantage of the former. At 10 years, the average of the favored classes is 2.88 inches taller, 1.09 pounds heavier, and 3.61 inches greater in chest girth. At 17 the average of the favored class is 3.39 inches taller, 31.6 pounds heavier, and 4.60 inches greater in chest girth. Yet if we take into consideration the actual sizes of both classes at 10 years, the increases except for weight are not significantly greater. Thus :

	Height Increase. 10-17 Years.	Chest Increase (empty). 10-17 Years.	Weight Increase. 10-17 Years.
Favored,	14.4	5.4	80.6
Artisan,	14.2	4.5	50.1

From Key's tables, instituting a comparison between the favored classes in the middle and preparatory schools and the poorer classes in the Volkschulen, the data show the amount of growth for the two periods as follows :

	HEIGHT.		WEIGHT.	
	6-10 Years.	10-17 Years.	6-10 Years.	10-17 Years.
Boys—				
Favored,	12 cm.	23 cm.	7.5 kg.	22.0 kg.
Poor,	12	23	6.2	15.6
Girls—				
Favored,	16	25	7.8	19.5
Poor,	13	24	7.8	18.0

The writer has similarly calculated the percentages of growth from 6 to 10, and 10 to a later age, as made possible by the data upon favored and unfavored classes, offered by the Anthropological Commission, Geissler and Uhlitzsch in Freiburg, Erismann in Moscow, and Hertel in Denmark. The results are by no means conclusive. In weight the evidence is stronger that poor nutrition retards the rate of growth, but the conflict of results suggests that factors other than those of nutrition enter, and that data must be first obtained free from such complications before the problem can be definitely solved. Perhaps the safer form of conclusion is that from ages 6 to 17 the rate of growth is not so distinctly affected by differences in nutrition as the actual divergence of size at any given age would suggest, and that of rates of increase in height and weight, the latter seems more susceptible of retardation due to this cause.

Porter (⁷⁸) expresses a suggestive and important theory, if true, that differences due to social conditions have slight effect before the prepubertal acceleration.

Porter compared the weight of 2,000 girls, separated into the classes, daughters of professional men and merchants (655), and the daughters of artisans and laborers (1,345), of St. Louis. During the 7th and 8th years, the daughters of the artisans and laborers were heavier by .42 and .11 kilograms respectively, but at 8 years the daughters of the professional and mercantile classes gain the slight ascendancy and maintain it by the following differences in kilograms:

Age.	8	9	10	11	12	13	14	15	16	17
	.11	.37	.15	1.18	1.58	1.97	2.09	1.87	.98	2.51

Porter's conclusion is not clearly supported by comparisons from other investigations. Though valuable as a tentative suggestion, it is as yet, in the condition of facts, premature.

Influence of different food stuffs: The influence of different foods upon growth has been submitted to an accurate experimental test by Malling-Hansen in a Deaf and Dumb Asylum of Copenhagen. It was, in fact, the purpose of the elaborate system of weighings, previously described, to determine the influence of various foods. On May 16, 1883, a change of diet at the asylum went into effect. The previous diet consisted largely of black bread and beer. The new substituted white bread and milk, and in other details made it considerably richer in albuminous food. Malling-Hansen compares the growth in weight under the two diets, for eight months, from September 11, 1882, to May 11, 1883, with the beer and black bread; and from September 11, 1883, to May 11, 1884, with white bread and milk. The 70 boys, in the aggregate, increased 105 pounds more under the new diet than under the old. But, Malling-Hansen points out, this increase was not distributed evenly over the eight months from May to December. On the contrary the curves of increase for the two years, under radically different foods, ran practically parallel for the six months and a half from November 22 to May 11. The whole increase took place in the month and a half from October 11th to November 22d. In the case of the girls the difference of increase, under the two forms of diet, was 76 pounds, and all this was gained in 32 days. As a conclusion Malling-Hansen is inclined to discredit any direct material influence of different foods upon growth, and to ascribe all direct causes of acceleration to internal forces.

Dr. C. Voit of Bavaria, in a brief monograph, enters a forcible criticism to Malling-Hansen's conclusion that difference in foods has nothing or very little to do with growth. He contends that weight is no true index of the essential pro-

cesses of growth. Increase in weight may be due (and he offers facts in proof) simply to greater absorption of water by the body, or by mere addition of fat. Only an exact chemical analysis could reveal the effects of the change in diet described by Malling-Hansen. The children may have been making essential increases in growth which the scales under certain circumstances would not reveal.

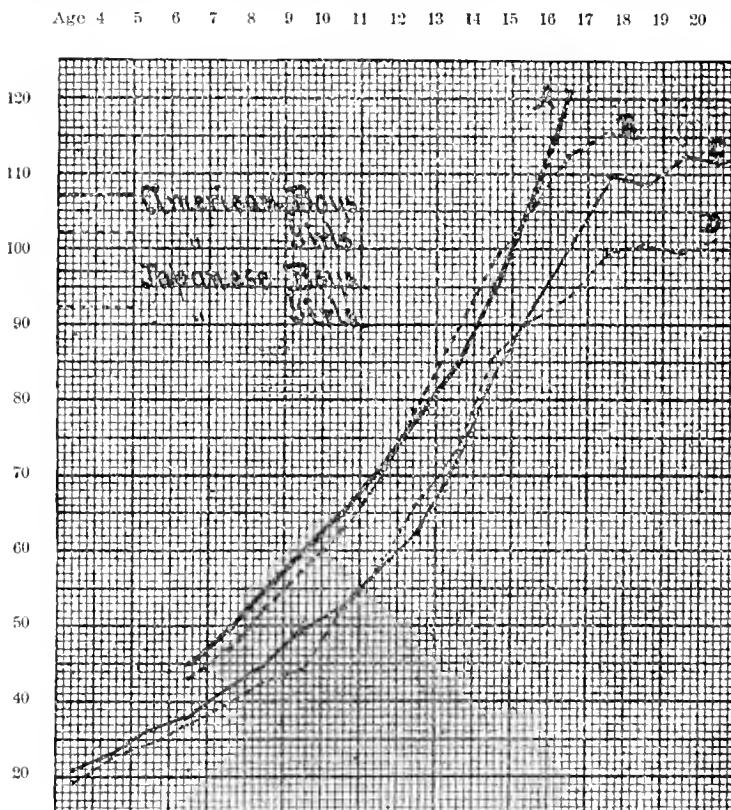
Boas (¹³) quotes Cartier as proving that children of unfavorable nutritional environment brought under favorable condition grow more rapidly than the rest, who are left in their former conditions.

The effect of different foods upon infants has been investigated by Russow (⁸⁴) in Oldenburg Hospital. Some infants were nourished exclusively at the breast and others were given a mixed diet. At 15 days the average of the first class was 3,564 grammes and the last class 3,525 grammes. At the end of this year the infants nourished exclusively at the breast weighed on the average 9,930 grammes, and those on a mixed diet 8,480 grammes, showing a difference of weight of 1,450 grammes. The breast-nourished infants increased 150.7% of their weight at 15 days, and those of the mixed diet 140.7%, which is not a difference of striking suggestion in favor of the effects of superior nonnishment. More conclusive is the evidence furnished by Camerer (²³). Fifty-seven infants, all weighing over 2,750 grammes and averaging 3,450 grammes at birth, were fed at the breasts of mothers or nurses, and at the end of the first year averaged 9,889 grammes; on the other hand 31 infants, all weighing more than 2,750 grammes and averaging 3,221 grammes at birth, were nourished by artificial preparations, and at the end of the year averaged 9,954 grammes; the latter were, therefore, slightly lighter at birth and heavier at the end of the year. The curves of growth given by Camerer show in the middle of the year the breast-fed children were heavier, but he concludes that whatever the nourishment during the first year, nevertheless all children at the end of the year reach about the same weight. Of course, he means to except children who are very materially lighter at birth, for whom he gives separate tables. Eighteen cases of infants averaging 2,390 grammes at birth, fed upon a mixed diet of breast milk and artificial preparations, weigh on the average at the end of the year but 8,490 grammes, and 10 others averaging 1,630 grammes at birth, under a similar diet, reach 6,610 grammes at the end of the year. Camerer gives about fifty individual cases, tabulating weights by weeks, and there is no evidence of the effects of differences of food, judging from the compared results at the end of the first year. If anything, results favor artificial food.

Influences of Race: It is the general conviction of students of anthropometry that race, as a factor in determining growth, is one of significant if not of first importance. But the consideration of this problem leads further into the realms of pure anthropometry than a pedagogical study would justify.* There is little material in the investigations of growing children that sheds conclusive proof. In a general way, by com-

CHART V.

Comparing curves of growth in weight of average American boy and girl (taken from Table I) and of average Japanese boy and girl (taken from data of Dr. Miwa). Figures on left are in pounds.



* The Lowell Lectures by Professor W. Z. Ripley, published in the *Popular Science Monthly* during 1897, are particularly illuminating on this subject.

parisons of investigations of growth in different countries, given in the tables, it will be seen that at a given age American children are, as a rule, taller than European children, and that in Europe the Italians and Belgians are shortest. Baxter and Gould, as already stated, have drawn important conclusions for growth under American conditions. Bowditch (¹⁹) gives the most comprehensive treatment relative to growing children, and inclines to the recognition of racial influences of considerable importance. Peckham follows the general plan of Bowditch's investigation, and finds that Milwaukee children of American parentage are about half an inch taller than children of German parentage. His tables would indicate that these racial differences are more pronounced after the tenth year, beginning with the prepubertal acceleration. Peckham can reach no conclusion regarding the influence of race upon weight. Porter, in St. Louis, finds no traces justifying a conclusion of considerable influence of race as a factor. Landsberger deals with the subject somewhat, finding up to the 10th year at least no appreciable differences between children of German parentage and Polish children. He criticises Bowditch's conclusions recognizing racial influence upon the children of Boston. The Report of the Anthropometrical Committee in England (³⁷) gives considerable data, tables and charts indicating differences in size of the people in various parts of Great Britain and Ireland.

Bowditch reviews the statistics of Erismann in Russia and Pagliani in Italy, and concludes that Italian children are in early life very much smaller than American children; although they make a gain later, they never overtake Americans. The Russian factory children also are smaller throughout, but these children, of course, as Bowditch states, do not represent the typical Russian growth.

Climate: Climate as a separate factor exerting a direct influence upon growth in height and weight, has received comparatively little attention upon a statistical basis. Peckham briefly reviews the facts, and concludes "that climate has any considerable effect in modifying growth seems quite improbable. Theoretically, a low temperature ought to stunt men, since a large amount of energy would be expended in maintaining the bodily heat; and the further strain upon the digestive system to provide the large quantity of food necessary for this purpose would leave a smaller surplus for growth. The evidence, however, so far as we can disentangle it, does not justify this inference. Taking a wide survey of the facts, we find that the Western Esquimaux, the negroes of Guinea, the Australians, the Patagonians, the Kaffirs, all have an average height of over 170 centimeters. In Europe the non-

dependence of stature upon latitude is patent. For South America, D'Orbigny discarded the theory most emphatically. Dr. Baxter's table showing the order of superiority, by states, of American-born white men, is a remarkable series of observations for refuting the supposition."

The Anthropometric Committee's Report (³⁷) of stature in different parts of Great Britain and Ireland deals extensively with this feature, and certainly shows significant variations with localities, but to conclude that climate is the determining factor is merely, of course, an hypothesis. Dr. Beddoe (^{†4}), speaking of this fact, says: "The idea that climate, *per se*, has any influence upon stature is very little supported by our materials. At the first blush, we might be disposed to think that a northern position and a somewhat vigorous climate operated favorably probably by natural selection. Climate, where it does influence the growth of men, probably does so, either through natural selection or by affecting his food and mode of life." In America, the growth of children in various cities, as cited, shows different degrees; but these objections, of course, hold against concluding that climate is the determining condition. Peckham, for example, explains the larger growth of Milwaukee children over Boston children upon a theory of a greater density of population in the latter city. Dr. Gould and Dr. Baxter, already cited, deal with the problem, in its adult relations for America, and their results would support the view of the influence of climate. The climate has generally been supposed to regulate the time of pubertal acceleration and this, as Key (^{†59}) points out, is earlier by a year in Italy and America than in Sweden.

Bowditch (²¹), reviewing Baxter's and Gould's results, concludes that the fact that natives of the Eastern States emigrating in childhood to Western States resemble the natives of the states to which they emigrate, justifies serious inquiry into climatic influences.

The subject of climatic influences as a factor of variation in growth may therefore be taken as yet undetermined, though it hardly seems possible that, at least in some indirect way, it is not important.

GROWTH IN RELATION TO SUSCEPTIBILITY TO DISEASE.

There seems to be evidence that children are able to resist diseases at certain ages better than at other ages. This conclusion is based upon studies in the death rates of children

(⁴) P. 173.

(⁵⁹) P. 79.

and by studies of the prevalence of diseases at different ages of children, undertaken chiefly in Sweden and Denmark. In the report of Dr. E. M. Hartwell, director of physical training in the Boston public schools (1894), is found the conclusion that the period of pubertal change, approximately the five years between the 11th and 16th years, is the period of lowest death rate. The basis for Dr. Hartwell's conclusion rests upon the census returns of Boston for 1875, 1885 and 1890. The rate of deaths per 1000 inhabitants for these three census years together is as follows:

TABLE K.
Showing Children's Death Rate in Boston (Hartwell).

AGES.	F.	M.
0-1	256.24	299.51
1-2	117.58	137.98
2-3	37.01	38.14
3-4	24.80	26.51
4-5	21.55	20.73
5-6	16.44	14.85
6-7	14.38	13.40
7-8	9.62	9.35
8-9	8.11	6.09
9-10	5.11	7.41
10-11	5.23	4.77
11-12	3.23	4.28
12-13	4.30	3.44
13-14	6.17	4.18
14-15	5.83	3.98
15-16	5.89	5.31
16-17	6.57	6.58
17-18	7.94	6.43
18-19	6.32	10.40
19-20	10.48	10.25
20-21	6.95	11.21

The death rate steadily decreases from birth until the 13th year. The decrease from 5 to 12 years is at a slower rate than for the first five years. These figures, of course, do not argue necessarily that all children are more susceptible to attack in the earlier ages, for it must be remembered that the large numbers who die in infancy remove the children more susceptible to sickness. In the percentages for boys, it will be observed that there is a slight rise in the 10th year.

The year of minium death rate is not always the same, Dr. Hartwell points out. It was the 12th year for girls during 1875 and 1885, but the 13th for 1890; in the case of boys, the minimum year was the 13th in 1875, the 14th in 1885, and

the 15th in 1890. It will be safer, therefore, in considering these figures, to regard the whole pubertal period as one, in a general sense, of strong vitality. The year of strongest vitality for boys is, we see, one year later than that of girls, following, therefore, the periods of development in the sexes. Dr. Hartwell cites Dr. William Farr as calling attention many years ago to the fact that the death rates of England fell to their lowest point in the period 10-15 years of age, during which puberty is established, and rose thereafter. "That the period 10-15 is the half decade in all human life," Dr. Hartwell concludes, "in which the fewest deaths occur to a thousand living, is illustrated in the vital statistics of all civilized countries."

The chief studies bearing upon diseases in the growing ages are those of the Danish (⁵⁷) and Swedish (⁵⁸) Commission; the Report of the Committee on Mental and Physical Condition of Children in England (¹⁰⁹), Combe of Lausanne, Hertel (⁵²) in Denmark, and Schmidt-Monnard of Halle. The results of the Danish and Swedish Commissions are so similar in many respects that they can conveniently be reviewed together. In Denmark, in 1883, the Danish Commission examined 17,595 boys and 11,646 girls in the higher schools and Volksschulen, 6 to 19 years of age. The information was obtained from teachers, parents, official school physicians and family physicians. The diseases reported are chiefly the distinctly chronic diseases: the acute complaints were excluded. The chief diseases are scrofula, anaemia, nervous complaints, headache, nose-bleed, chronic indigestion, chronic lung and heart complaints, curvature of the spine, and other chronic diseases such as kidney complaints, rheumatism, etc. Short-sightedness is treated separately, and the figures concerning this disease are not included in the present discussion.

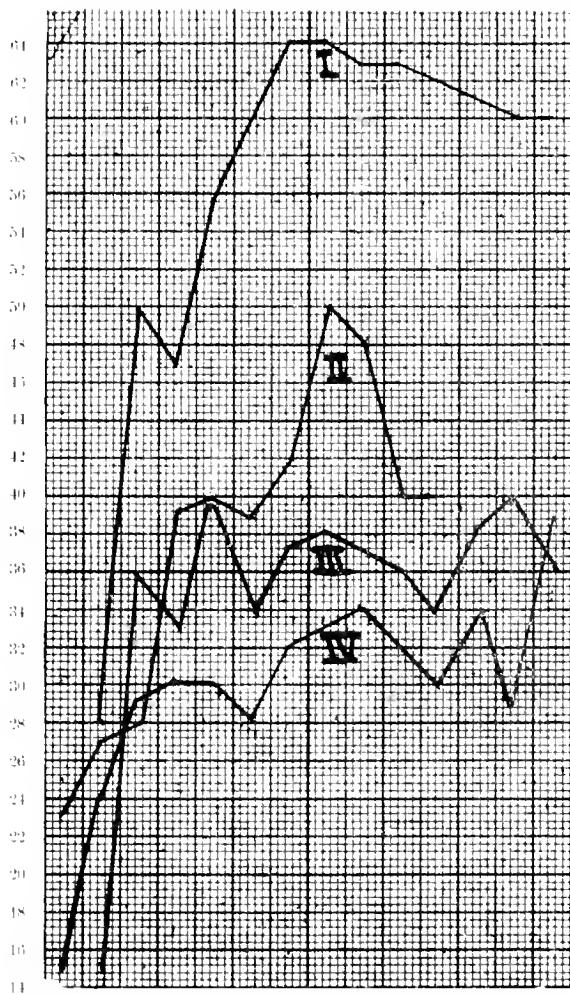
The Swedish Commission undertook its work about the same time. The diseases investigated were practically the same. The Swedish Commission, however, dealt with a larger number of pupils in the higher schools and preparatory schools, but excluded data from the Volksschulen. The results are, therefore, not exactly comparable. Diagrams express graphically the prevalence of chronic diseases at different ages, and it is seen at a glance that the form of the curves is singularly alike in both investigations. About 14 to 16 per cent. of the boys at six years of age are afflicted with some chronic disease. The curve rises with abrupt rapidity, until the latter part of the ninth year, when the Swedish curve shows a sudden sinking of 4 per cent., and again rapidly rises in the 11th year. The rate of Danish curve slackens and shows a stationary tendency until the 11th



CHART VII.

Showing per cent of chronic diseases in Sweden and Denmark (adapted from Hertel). I, higher girls' schools of Sweden; II, higher girls' schools of Denmark; III, gymnasia and preparatory schools boys of Sweden; IV, approximately comparable schools to III of Denmark. Figures on left represent the per cent. of children affected.

Age 6 7 8 10 11 12 13 14 15 16 17 18 19 20



year. During the 11th year both curves have reached a crisis. Both fall to their lowest point in the 12th year, the healthiest in the pubertal period. There is then a gradual rise in each, reaching a second summit, in Sweden, in the 14th year and in Denmark in the 15th year, and both sink in the 17th year, the close of the period of rapid growth, to rise abruptly in the 18th and 19th years. Hertel's own investigation (⁵²), undertaken in 1881 upon 3,141 boys and 1,211 girls in the higher schools of Copenhagen, practically agrees in form with the foregoing in essential fluctuations.

The disease curves for girls show the same agreement in form in the two investigations, though, as in the case of boys, disease is proportionately more prevalent in Sweden than in Denmark. At 6 years, from 22 to 25 per cent. of the girls are afflicted with chronic complaints, and the curve rises gradually until the 14th year and then sinks, rapidly and considerably in Denmark, and but slightly in Sweden. Two fluctuations are to be observed, one in the 9th year in Denmark, and from the middle of the 9th to the 10th in Sweden; a second, more distinct in Sweden from the 11th to the 12th year. It would seem at these periods there is a slight improvement in health of the girls.

Combe of Lausanne gives data more upon the individual plan. His observations are upon about 2,000 school children, covering a period of 6 years. Combe's figures give data only from the 9th to the 15th years. His data include some of the infectious as well as chronic diseases, and, therefore, are not comparable to those of the Danish and Swedish Commissions. In the 9th year 64 per cent. of the boys are afflicted, but the curve abruptly sinks to 29 per cent. in the 14th year, just before the year of most rapid growth in height (43 in 10th year, 42 in 11th, 40 in 12th, 33 in 13th); from 29 per cent. in the 14th year the disease curve rises to 34 per cent. in the 15th. With girls there is a percentage of 88 per cent. in the 9th year; it falls to 75 per cent. in the 10th and 60 per cent. in 11th, but with increase in rapidity of growth, rises to 66 per cent. in 12th and 68 per cent. in 13th; then sinks to 61 per cent. in 14th, and 39 per cent. in 15th year.

Schmidt-Monnard's study upon several thousand pupils in the higher and middle schools of Halle, is approached largely from the assumption that the schools are responsible for sickness, and his effort is chiefly to trace this causal relation. However, his data show whether the causes be in the schools wholly or partly in organic conditions of growth, that there is from 5 to 10 per cent. less sickness among boys than girls at all ages; that the amount of sickness varies with kind of schools, social condition of pupils, and grade (or age). Averaging his results he finds that the sickness curve steadily

rises until the 13th or 14th year in both sexes, and then falls from 30 to about 18 per cent. with boys, and from 30 to 40 per cent. in the case of girls, to 27 per cent. His data do not give information beyond the 15th year. Among the conclusions of the author are the following: Acute diseases occur principally in the primary school years, and in general are more frequent and persistent in children of unfavorable nutritional conditions than among the favored classes—among Bürger school children less than among the Volksschulen; chronic diseases increase during the school year and are especially induced in schools having an afternoon session, or children burdened by outside duties such as music, house-work, etc.; in the 13th or 14th year there is nominally a decrease in the percentage of disease.

The Report of the British Committee on Mental and Physical Condition of Children (¹⁰⁹), embracing the results of Dr. Francis Warner's investigation and covering the data of 100,000 English children, is not classified in form and matter in a way that permits comparison with the foregoing studies.

This report, together with Dr. Francis Warner's publications, furnishes information and suggestions which no one responsible for the care of children can afford to be without. The report deals chiefly with: (1) defects of development of the body and its parts in size, form, or proportion of parts; (2) certain abnormal actions, movements and balances due to nervous abnormalities or disturbances; (3) low nutrition; (4) mental dullness. All of these publications are readily available in English. The report is published by the Committee, Parker Museum, Margaret street, London, W. (1895). Dr. Warner's original report of 50,000 children (which comprises half the present report) is reprinted in the Report of the Commissioner of Education (U. S.), Vol. II, for the year 1890-91.

Growth and Resistance to Disease: There has been an attempt to connect the periods of rapid growth with those of power to resist disease. The figures upon death rates, as Dr. Hartwell concludes, certainly point to this conclusion. Dr. Hartwell in support of his position gives the following table, comparing the rate of growth in both height and weight with what he terms "specific life intensity;" by this he means the ratio of the number dying at a given age to the number living at that age. When this ratio is high, a high power of resistance to disease is indicated, and *vice versa*.

Axel Key of the Swedish Commission agrees with Dr. Hartwell in linking better resistance to disease with accelerated growth, and the susceptibility to disease with the periods of slow growth. "The curve of disease (in boys)," he ob-

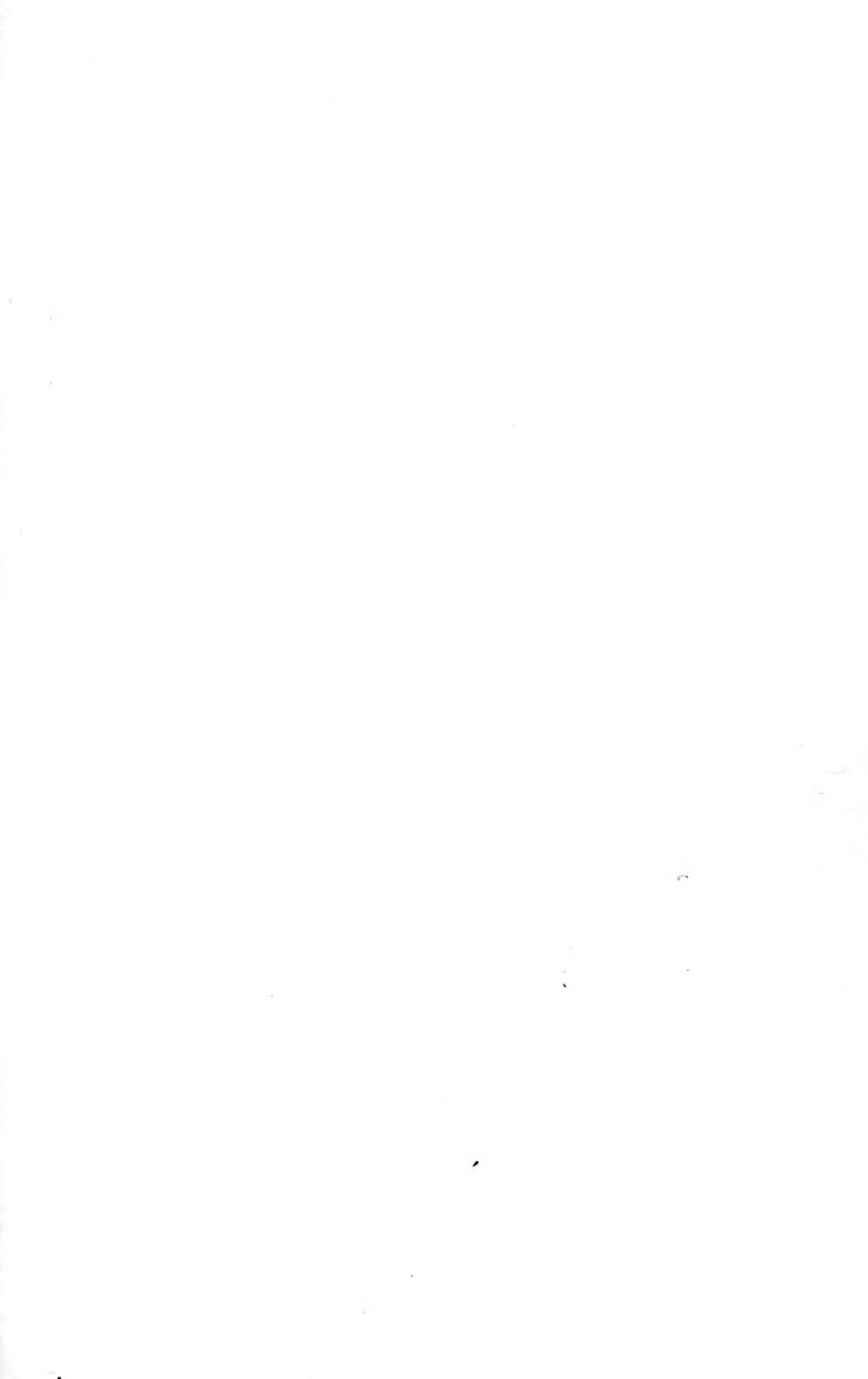


CHART VI

Comparing specific life intensity with rate of growth in height and weight for Boston children. Curves I (boys) and II (girls) show specific life intensity (taken from Table L); curves III and IV and curves V and VI represent respectively the percentage annual increases in weight and height as given in Tables G and C. Continuous line represents boys, and dotted line girls. Figures on left apply to curves I and II; figures on right to III, IV, V and VI.

Age: 5 6 7 8 9 10 11 12 13 14 15 16 17 18

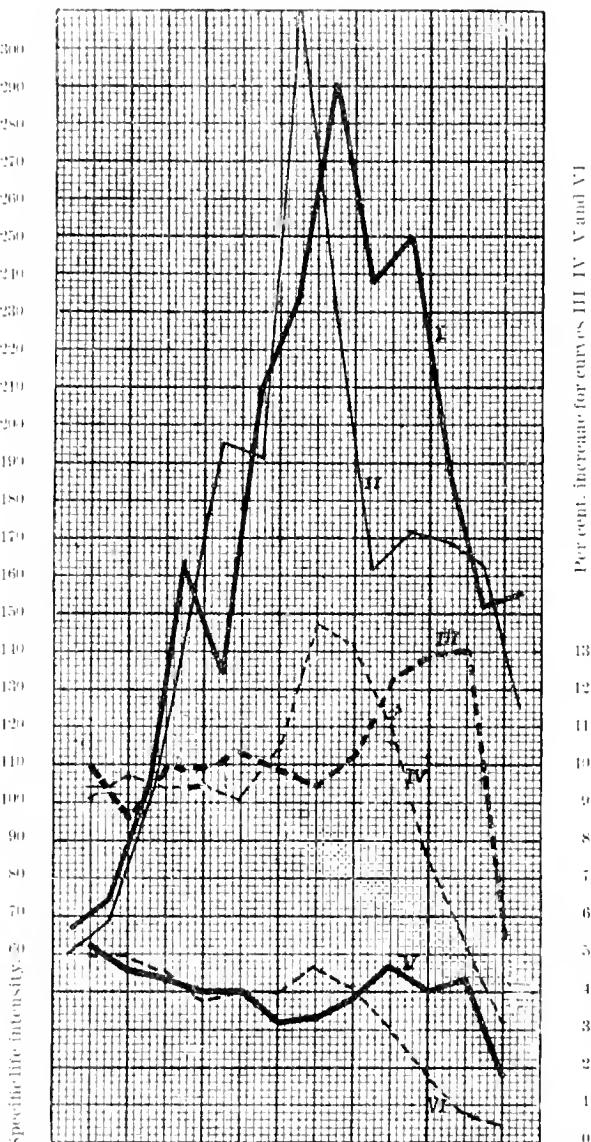


TABLE L.

*Showing Specific Life Intensity of Boston Children at Different Ages
(Hartwell).*

(The figures in heavy-faced type indicate the pubertal years.)

AGE.	Per Cent. Increase. Height.		Specific Life Intensity.		Per Cent. Increase. Weight.	
	Girls.	Boys.	Girls.	Boys.	Girls.	Boys.
5— 6	4.00	5.20	60.08	67.3	8.88	10.24
6— 7	4.08	4.58	69.5	74.5	9.69	8.78
7— 8	4.58	4.38	103.8	106.8	8.83	9.86
8— 9	3.72	4.03	123.2	164.0	10.68	9.79
9—10	3.98	4.04	195.4	134.8	9.26	10.40
10—11	4.06	3.12	191.2	209.3	10.24	7.43
11—12	4.56	3.39	309.0	233.2	13.78	9.74
12—13	4.08	3.78	232.0	290.1	13.23	10.31
13—14	3.11	4.68	162.0	238.7	10.94	11.66
14—15	1.90	4.01	171.3	250.1	7.83	13.02
15—16	.77	4.36	169.3	188.1	5.61	12.96
16—17	.51	1.75	152.0	151.9	3.14	5.23
17—18	....	.77	125.6	155.3	...	3.97

serves, "reaches its first summit directly before, or, more correctly, at the beginning of the pubertal development. But as soon as this development sets in forcibly, the curve sinks year by year, so long as that accelerated growth continues. The curve is lowest the two last years of the pubertal period, just when the increase in weight is greatest. Directly at the conclusion of the pubertal period, when the yearly increases in height and weight hastily decrease, the curve of disease, on the other hand, jumps to its second summit, which it reaches in the 18th or 19th year (^{†58}). The year of strongest health is, therefore, the 17th. For no year is the height of the curve of disease so great as for the 18th, and next to it is the 13th. On the other hand, regarding the period of slow growth from the 8th to the 12th year, Key con-

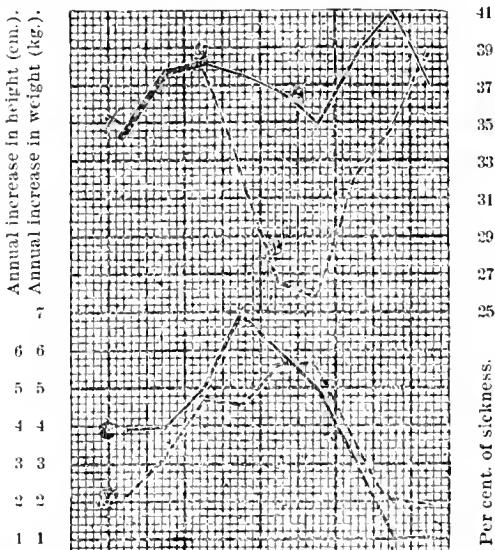
(⁵⁸) P. 250.

cludes, "All facts point unquestionably to the conclusion that the period of slow development preceding puberty is a period during which the power of resisting injurious external influences is weak, and the percentage of sickness increases, particularly in the years immediately prior to the pubertal

CHART VIII.

Percentage of chronic disease in Swedish boys' schools in comparison with rate of growth (after Key). Curve x-y, sickness in Volks classes; curve A, sickness in Latin classes; curve B, sickness in Real classes; curve C, annual increase in weight (kilograms); curve D, annual increase in height (centimeters). Figures on right represent percentage of pupils affected by disease.

School class.	I	II	III	IV	V	VI	VI ¹	VI ²	VII
Average age,	11	12	13	14	15	16	17	18	19



development." In the case of girls, Key finds that the relation of rapid growth and decrease of sickness does not appear so sharply defined as in the case of boys. He says, "With the development of girls throughout, the curve of sickness reaches its first summit in the second pubertal year (the 13th), which is the year of accelerated increase in weight, and sinks thereafter very little, and rises not directly after the conclusion of pubertal growth, but in reality two years later (in the 18th). We see, therefore, that the last year of puberty must be recognized as the weaker in resistance than the one which directly follows the close of the period."

Hertel (⁵³) in Denmark, in his discussion of his own investigation and that of the Danish Commission, seeks to find the causes of fluctuations of the percentage of disease in various years in local conditions of the school and the home, rather than in any organic relation to the growth processes. He says, however, of the period of three or four years prior to the pubertal change, "It would appear that this change is preceded by a short period of greater delicacy than usual, with greater susceptibility to unfavorable external influences" (⁵²). "The maximum percentage of disease," he says, "is reached in the 12th or 13th year, directly at the threshold of the pubertal period. The strong physical development during this period is not able to lessen materially the percentage of sickness, and the amount of sickness in these remains high in the case of both boys and girls" (⁵³). Dr. Hertel apparently agrees with Key of Sweden that the impulses of growth in the pubertal period tend to inhibit diseases, but the other unfavorable conditions, both external and internal, tend, on the other hand, to increase sickness. Thus he concludes, "Indeed, these unfavorable influences must be influential after the period of puberty, since immediately after this period, as soon as the accelerated period of growth and with it the greater power of resistance to disease, ends, sickness increases abruptly and very considerably" (⁵³). His conclusion is based upon the following tables from the report of the Danish Commission :

TABLE M.

*Showing Percentages of Chronic Diseases in Danish Boys' Schools
(Hertel).*

	No.	AGE.												
		6	7	8	9	10	11	12	13	14	15	16	17	18
Gymnasia,	2,099	—	—	—	—	—	26	52	33	34	32	30	34	29
Real Schools,	4,343	15	24	29	30	30	28	29	30	29	22	26	31	25
Bürger Schools,	2,313	16	21	23	28	31	29	27	25	24	22	10	38	—
I. Volksschulen.														
City { Tuition,	3,746	21	24	26	26	29	28	31	30	30	—	—	—	—
Free,	2,047	32	32	34	33	37	37	37	33	26	—	—	—	—
Village { Bauer,	1,446	13	13	28	27	30	27	30	29	28	—	—	—	—
Arbeit,	938	—	28	33	30	28	30	35	25	—	—	—	—	—

TABLE N.

*Showing Percentages of Chronic Diseases in Danish Girls' Schools
(Hertel).*

	No.	AGE.											
		6	7	8	9	10	11	12	13	14	15	16	
Higher Schools, Volksschulen.	3,858	23	27	28	39	40	39	42	50	43	40	40	
City { Tuition,	3,023	24	36	33	38	41	44	45	57	52	--	--	
{ Free,	2,018	31	37	40	42	51	48	60	55	53	--	--	
Village { Bauer,	1,379	21	24	29	33	44	36	52	46	50	--	--	
{ Arbeit,	872	29	39	33	36	44	53	49	57	56	--	--	

Combe of Lausanne reaches conclusions diametrically opposed to those of Key relative to the relation of growth and disease. He says (²⁵): "Sickness increases with growth; in other words, the more a child grows, just so much the more is it inclined to disease. The periods of most accelerated growth represent, therefore, the periods during which the organism possesses the least power of resistance to disease." He offers the following table, compiled from data of 2,000 school children of Lausanne, during a period of six successive years.

TABLE O.

*Showing Percentage of Sickness in Schools of Lusanne by Years
(Combe).*

AGE.	BOYS.		GIRLS.	
	Per cent. of Sickness.	Annual Increases in Height in cm.	Per cent. of Sickness.	Annual Increases in Height in cm.
8—9	64	4.8	88	4.9
9—10	43	4.7	75	4.9
10—11	42	4.4	60	4.9
11—12	40	4.1	66	5.4
12—13	33	4.4	68	5.5
13—14	29	4.6	61	5.1
14—15	34	7.0	39	5.0

It must be remembered, however, that Combe's investigation is not comparable with those in Denmark and Sweden, for the reason that Combe includes a few of the infectious diseases; and further, he compares sickness with acceleration in height, while Key's conclusions are based upon comparisons with acceleration in weight which reach a maximum a year or so later. Combe, however, under some misapprehension, cites both Hertel and Key as supporting his view.

With regard to the period from 7 to 11 years in girls and 7 to 13 years in boys, Combe concludes that sickness is greater among the former than among the latter, and always increases directly in proportion to the rate of growth.

The studies, which have been reviewed with the exception of those of Combe, have dealt almost exclusively with the chronic diseases, ignoring the acute complaints. Another important field of data, therefore, is that of the normal epochs for the appearance of the usual children's diseases. Clouston's "Neuroses of Development" is a valuable handbook for the teacher, dealing with certain developmental diseases; chorea, for example, which is a disease of serious importance in pedagogy, occurs, according to Clouston, chiefly between the ages of 6 and 15 years: seventy-five per cent. of the cases occur during this period, and only fourteen per cent. during the period of adolescence. The publications of Crichton-Browne are also most helpful and important.

In the field of strictly medical literature, there is a mass of scattered facts bearing more or less directly upon the problem at issue. Dr. Boulton (¹⁷) says: "Arrest of growth or loss of weight precedes so many diseases that it may be looked upon as a danger signal, and if the 'caution' is noticed before the disease point is reached, catastrophe may frequently be prevented, and so, childhood may be worked on a kind of block system."

Dr. Moulton (⁷³) offers several cases of insanity showing a direct relation between gain and loss in weight with improved or impaired mental condition of the patients. When patients improved, weight rose, and *vice versa*.

Dr. Evetzky (³³) finds among infants that disturbances of nutrition incident to dentition are indicated by a decided diminution in the normal rate of growth.

Dr. H. P. Bowditch (²¹) says, "It has been frequently remarked that a period of rapid growth is apt to follow certain fevers, and it would, therefore, be very interesting to inquire whether this accelerated growth after the disease is anything more than a compensation for loss during the disease, and whether in this period of rapid growth the height and weight preserve their normal relation to each other." Dr. Bowditch offers an interesting chart in the same article tracing the variations in weight of an infant girl from September to April. The periods of slight sicknesses are coincident with loss in weight, and *vice versa*. The curve, however, is singularly like those due to seasonal changes, according to Malling-Hansen's law.

RELATION OF SIZE TO PRECOCITY AND DULLNESS.

Dr. Townsend Porter (⁷⁹) from his study upon St. Louis school children concludes that, on the average, precocious

children are heavier and taller than their duller fellows of the same age. Dr. Porter's basis for this conclusion may be briefly summarized as follows: He tabulated the heights and weights of 34,500 boys and girls from the kindergarten through the high school. He then classified the pupils of the same age in tables, showing the school grades to which they belonged. Boys of 9 years, for example, are found to be distributed from the first to the fifth grades inclusive. He then calculated, by Galton's system, the mean weights for each age irrespective of grade, and also the mean weight of pupils of each age for each grade in which they are found. His figures very distinctly show, taking a given age, that the pupils of that age found in the higher grades are heavier and taller than the pupils of the same age found in the lower grades. For example, the mean weight of boys of 11 years is 68.47 pounds. Boys of this age found in the first grade weigh 63.5 pounds; in the second grade, 65.45; third, 68.12; fourth, 69.24; fifth, 71.29; sixth, 73.34 pounds.

Table P gives Porter's results, showing the distribution of girls and boys of the same age throughout the grades, according to weight. The figures for girls are in heavy-faced type, those for boys in light-faced.

Porter does not give complete tables with regard to height, but the following figures for boys of 10 years and girls of 12 years he considers sufficient to indicate the same law with regard to height:

	Mean Height in Centimeters.					
	Grade I.	II.	III.	IV.	V.	VI.
Boys, 10 years,	126.5	129.39	130.29	131.22		
Girls, 12 years,		136.06	139.04	140.08	141.96	141.9

Dr. Porter also shows a relation in the same manner between the chest at forced expiration and width of head to precocity.

In verification of his results, Dr. Porter cites similar but very much smaller investigations in Russia, one by Dr. Gratsianoff and another by Dr. Sack. Both found that successful pupils are larger and have larger chests than unsuccessful, but Sack disagrees with Gratsianoff that the rate of growth in the successful is quicker.

Dr. Franz Boas (¹¹) criticises, in some degree, Dr. Porter's results, contending that what Dr. Porter has shown is that "mental and physical growths are correlated; not that mental development depends upon physical growth." Dr. Boas points out that naturally the sickly of a given age will be retarded in their advancement.

Three other attempts have been made to find a relation,

TABLE P.

Showing Relation of Precocity to Weight as Indicated by Distribution of Heavy and Light Children of the same Age in the Different Grades of St. Louis Schools (after Porter).

Age at nearest Birth- day.	Mean Weight Lbs.	GRADE.									
		Kind.	I	II	III	IV	V	VI	VII	VIII	HighSch.
6	43.74 41.84	43.58 41.65	45.29 45.08								
7	47.73 45.84	45.58 43.87	48.48 46.76	52.00 49.88							
8	52.58 50.35	47.80 46.50	51.79 49.60	54.43 52.10	57.00 53.17						
9	57.75 55.17		55.87 52.57	57.64 55.44	59.66 57.18	61.75 60.00					
10	62.48 60.46		60.19 57.00	61.14 59.59	64.00 61.15	64.91 61.64					
11	68.47 65.64		63.50 66.34	65.45 62.95	68.12 65.50	69.24 66.77	71.29 68.12	73.34			
12	73.61 73.23		70.00 71.75	69.50 69.80	72.17 71.50	73.86 72.74	74.69 75.13	77.29 75.92	76.50 78.50		
13	79.85 83.73			74.25 79.50	75.95 76.50	78.43 81.92	80.90 82.78	82.17 86.95	83.50 87.63	82.00 88.50	
14	88.08 93.94				81.00 90.50	84.00 87.17	87.83 92.67	87.20 94.64	93.63 96.15	97.50 99.00	86.50 103.12
15	100.20 103.20					89.00 98.50	95.33 100.96	99.17 99.83	105.50 104.00	105.17 104.58	105.08 105.15
16	114.17 110.06							114.50 108.12	104.00 107.33	114.00 110.29	123.00 113.57
17	115.69									111.00	116.00

either positive or negative, between precocity and physical growth: Dr. J. Allen Gilbert's studies upon Iowa and New Haven children, and the investigation of Toronto children by Dr. Boas. None of these use the test of precocity adopted by Porter, advancement in the grades, but take, as the test, the teacher's off-hand estimate or impression of quick intelligence.

Dr. Gilbert classifies the heights and weights according to the teacher's estimate of "bright," "average" and "dull." The number of children are about 100 for each year of age, 6 to 19. Upon this basis of test, there is no manifest relation. In weight, the bright children are slightly lighter on the whole and the dull children are heavier, most distinctly from 10 to 14 years. In height, about the same might be said. Dr. Gilbert feels justified in concluding, "The curves cross and recross in such a way as to show no constant relation between physical development and mental ability. If anything could be stated, it would be that the heavier and taller children are the duller, but here also the curves cross too frequently to justify any definite statement in regard to any relation so existing."

Dr. West with Dr. A. F. Chamberlain assisted Dr. Boas, in 1892, in making a study of children in the Toronto schools. The complete report is not yet published, but Dr. West has made a preliminary statement of results (¹⁰³). The stature and weight were taken and grouped with reference to mental power, according to the teacher's impression, as "good," "average," "poor." Dr. West summarizes: "We find that, as a general rule, the 'poor' children are more fully developed than the 'good' children, though in each series of measurements, there are one or two cases when the 'good' children show a higher average than the 'poor.' These cases are generally near the latter end of the series." Dr. West, in discussing the disagreement of Toronto results and those of St. Louis, contends that an error pervades Dr. Porter's results, since a number of pupils enter school at a late age and would, therefore, be incorrectly counted as "dull" pupils; further, that Dr. Porter's system of reckoning age according to the nearest birthday introduces a misinterpretation of results.

The stature of the Fellows of the Royal Society is slightly above that of the professional classes of England (¹³⁷), and Roberts' tables show that the professional classes of England are distinctly taller than any other class. Roberts' tables also show that, compared with the general population, lunatics are shorter by 1.96 inches and lighter by 10.3 pounds. Clouston* finds that the 200 pupils of the National Institution at Larbert, England, are much under the normal average, both in weight and height. Dr. G. E. Dawson finds that in American institutions for defectives the children are distinctly undersized.

Dr. G. G. Tarbell of the Boston Home for Feeble-Minded

(³⁷) P. 21.

* "Neuroses of Development."

measured and weighed the inmates, ranging in age from 6 to 19 years, and constructed a chart, which by comparison with that of Dr. Bowditch indicates that the idiotic and feeble-minded children in that school are about two inches shorter and nine pounds lighter than normal children of the same age; that the relative rate of growth of the two sexes corresponds in principle with that of normal children and is subject to the same variations at the age of puberty; that the period of puberty is about two years later in idiots than in normal children.

A report by Dr. G. E. Shuttleworth of England confirms Dr. Tarbell's statements. The former gives a comparison of the heights and weights of 1,209 idiots and imbeciles in English asylums, showing a distinct inferiority as compared with heights and weights of normal children of corresponding ages. From data of 300 idiotic and imbecile children collected by Dr. Shuttleworth, he found that they were shorter than normal children by one inch at 5 years, two inches at 10 years, three inches at 15 years and 20 years. In weight, the defectives were lighter by four and one-half pounds at 8 years, at 10 years by six pounds, at 15 years by eight pounds, and at 20 years by twenty-three pounds. However, there are, as Dr. Shuttleworth points out, many factors that must be taken into account in comparison. They are more susceptible to disease than normal children, the mortality among them being probably nine times greater. Many are undoubtedly small at birth, and not a few have been prematurely born. The mortality curve follows Hartwell's law, being 50 per cent. for ages 5 to 10, 33 per cent. for ages 10 to 15, and 45 per cent. for ages 15 to 20.

GENERAL PRINCIPLES OF GROWTH.

Since Quetelet, a half a century ago, gave an impetus to the study of the phenomena of growth in the human body, much data have been gathered, but as yet few, if any, conclusive principles have been clearly established. A few tendencies to formulate laws, however, should be mentioned.

Growth by Rhythms. Probably the most elaborate effort to present wide general laws has been made by R. Malling-Hansen. It will be remembered that the autumn season is the period of maximal rate in weight and the minimal period for height; that spring reverses the relation and that winter is a period of moderate increase for both. In the daily rhythm* the same relation was observed, that what the body gained in height by night it lost in

* The average daily loss for the 72 boys was .64 kilograms.

weight, and gain in weight by day was accompanied by an actual loss in height. These facts, harmonizing with other phenomena of growth, seem to justify the conclusion of Malling-Hansen that the periods of most rapid growth in height are, to say the least, periods of rest in growth in weight, and *vice versa*. A significant fact is that the height periods begin and end about fifteen days before the weight periods. The author cautiously suggests as a possible hypothesis that the circumstances "that height increases most rapidly when weight decreases, and also the fact that the phases of growth somewhat precede those of weight, appear to signify that the increase in height has been directly at the expense of weight increases. It has the appearance that the growth in height at the conclusion of its maximal period (which is just when the period of increase in weight begins) had consumed its food that had been stored up in the body; and as if, therefore, in the course of the autumn (which is the period of maximal growth in weight) the means for beginning a new height growth were then cultivated. On the other hand, however, the fact occurs that the maximal period of height growth does not follow directly the increase in weight (*i. e.*, the winter period of slower growth in both height and weight intervenes). It would seem, on a little reflection, that growth in height and growth in weight must be very different processes." Malling-Hansen gives a very plausible explanation of these processes. He argues that since during the autumn maximal growth in weight the vertical increase in height is slight, that, therefore, some other explanation must be sought for this weight increase. He thinks the length of the period, four and one-half months, precludes the explanation that the body is merely absorbing water. Aside from the possible storing up of nourishment for later height growth, he concludes that the growth in weight is due to lateral extension of the body, a growth in thickness therefore. During the middle period, from December to April, when the body is growing both in weight and in height, the increments of the latter must be estimated as a factor; but how much goes for the vertical dimensions and how much for the lateral we are, of course, unable to determine. In the spring and summer, when the body is increasing in height most rapidly, it actually loses in weight, and we must conclude that during this period the process of decay of cell structures exceeds the constructive process. A loss in the amount of water may possibly be reckoned as a factor. Malling-Hansen, however, feels justified in laying down the following principle of growth: "In the maximal period of lengthening, the thickening of the body is at its minimum, and *vice versa*; the thickening has its

maximum in the time of minimal lengthening." He measured also a number of trees for a number of months, the tables of measurements of which he gives, and found the same law sustained. In early spring the trees grew in height, and later rested in height while they thickened out in circumference.

A very scholarly contribution to the principle of growth by rhythms has been made by Dr. Winifred S. Hall from study of Haverford College students and grammar school boys. He develops the same law of separate rhythms for height and weight in the larger periods before and during pubescence that Malling-Hansen uses for the seasons. He concludes: "When the vertical dimensions of the human body are undergoing acceleration of their rate of growth, the horizontal dimensions undergo a retardation of their rate of growth, and conversely." As ground for this important conclusion, Dr. Hall cites the following facts from his data: "If the percentage series of total girths be represented by a curve, the rate of growth of the ninth year will be seen to continue through the tenth, thus surpassing the height. From the 11th to the 13th year the increase is less and less rapid, and is surpassed by heights; from 13th to 14th, more rapid, and surpasses height; from 14th to 15th, the girths are again surpassed by heights; but during the 16th year the girths gain a permanent and ever-increasing ascendancy. That these curves cross each other four times between the 10th and 16th years is an exceedingly interesting fact. It may be considered as one of the most important laws of growth. A reasonable interpretation seems to be that the body widens and then takes an upward shoot, then widens out preparatory to another upward shoot. To make such a phenomenon possible it is necessary that the curves of height should show at least one period of rapid increase. The curve of heights shows (in his own data for males) two such periods, 12 to 13 and 14 to 15; Bowditch found two, 10 to 11 and 13 to 14; Pagliani, one, 13 to 17; Key, two, 12 to 13 and 15 to 16; Kotelmann, 12 to 13 and 14 to 15." According to Dr. Hall, the growth in height is due "largely to increase in the length of the long bones. If we can compare the girth of bones with their length, we shall find the same thing true of bone growth as of general body growth. The increase from 9 to 12 is unchanged, but when the bones begin to increase rapidly in their vertical dimensions, from 12 to 13, we find the increase in lateral dimensions essentially retarded, and when the vertical dimension undergoes its second retardation, between 13 and 14, the joint girths make an increase which more than makes up for their previous retardation." Dr. Hall makes this conclusion general.

Peckham (^{†76}) concludes: "The growth of the body and of the lower extremities takes place in such a way that the length of the body of the girl is less than that of the body of a boy until the 10th year, and thereafter greater until the 16th year. From 15 to 18 years the bodies of girls grow only two inches and the bodies of boys over four inches. For the lower extremities, at nine years of age those of the girl are longer, at 11 shorter, and from 12 to 14 again longer. At 14 the lower extremities of the girls almost cease growing, while those of the boys increase by four inches between the ages of 14 and 19 years.

This rhythm of alternating activity and rest in growth finds at least its analogy in cell multiplications and growth. The means of increase in number among cells of an organism and among the lowest orders of living matter is by division. The parent cell swells in size until a certain point is reached, and then, by a more or less complex process, divides into two parts. A period of rest then generally ensues, and somewhat later these two cells begin to swell and repeat the process. Whether this principle of activity and rest here exemplified has a direct relation in the growth of the complex higher organisms is, of course, a matter of mere speculation. Minot (^{†69}) points out that probably changes in one direction are counterbalanced by changes in an opposite direction, thus maintaining, it would seem, a balance on the average.

Growth by Parts. It has been a popular notion of growth that the process is continuous throughout the body; that if, for example, a cross-section of the various parts and organs were taken in equal divisions of time, the amount of growth in each part or organ would be found in the same proportions. The studies in physiology and anthropometry during the past half century or so have turned the drift of conviction toward the other extreme, and the problems of the present are those of "retarded" growths and "accelerated" growths, not only of the organism as a whole, but also in specific parts. While each part may be assumed to have some sort of relation to other parts, nevertheless the modern tendency is to discover the growths of the parts individually as a basis for investigation of the relations and dependencies of one form of growth, or the growth of one part upon the others. From the physiological standpoint, probably the most complete presentation of the data relative to this subject, collected and contributed, has been made by Vierordt.[†]

(⁷⁶) P. 35. See also pp. 32-33.

(⁶⁹) P. 195.

[†]Gerhardt's *Handbuch der Kinderkrankheiten, erster Band, erster*

Further, physiologists distinguish between a growth by increase in the number of cells and a growth consequent of mere swelling of cells already existent. The unstriped muscles, for example, actually increase in number of cells; but the number of cells in the brain, on the other hand, does not increase after birth—they simply swell in size. A third kind of growth is to be distinguished in the replacement of cells that have decayed. Still another complication of the growth problem arises in the increase in fat. This is not generally termed growth. After twenty-five years of age there is generally an increase in fat, materially adding to weight, and thus making it difficult to determine the exact amount of real growth. At best, therefore, growth in stature and weight is merely significant perhaps of activity of growth processes taking place in several parts of the body at once. To trace these growths in detail would far exceed the limits of this study, and would lead deeply into anatomical and physiological problems. That growth is relative in the different organs is neatly illustrated in a table by Bischoff, quoted by Donaldson (^{†29}), showing the percentages of weight of different parts or systems of the human body at birth, at sixteen years and at maturity. Commenting upon this table Donaldson says: "On comparing the proportion of the different systems in the new born with the adult, the following relations are worthy of remark: The percentage of the skeleton, fat and skin taken together, is but slightly smaller in the new born. The percentage of the viscera in the new born is nearly twice that of the central system, and more than eight times that found in the adult, whereas the proportional weight of the muscles shows only a trifle more than one-half its adult value. The purely constructional parts of the body, the skeleton, fat and skin, which are formed predominantly of connective tissue, have therefore not varied their proportions during growth; while the nutritive and controlling system, that is, the abdominal and thoracic viscera and the brain, have undergone a relative diminution, having in a most remarkable way been outgrown by the muscular system."

From birth to complete maturity the body increases in height 3.37 fold, and in volume 20.66 fold (^{†29}). Roberts (^{†32}) gives a succinct résumé of relative growths of different parts of the body. The

Abtheilung, 1881, contains a résumé by Vierordt of the subject to date, 288 pages with abundant tables. In the same volume is also a valuable collection of data upon the anatomy of children by Henke. Vierordt's *Physiologie des Menschen* (1877) and his *Anatomische Physiologische und Physikalische Daten und Tabellen* contain a mass of collected data of immense value.

(²⁹) P. 67.

(²⁹) P. 50.

(³²) P. 108 *et seq.*

head doubles in height, and the development of all horizontal measurements of the head is still less than that of its heights. It is not till about the sixth or seventh year that the neck commences to grow, and after adolescence averages about two inches. The diameter of the neck increases rapidly at the pubertal age. The height of the trunk of the body trebles from birth to maturity. The diameters of the trunk at the shoulders, chest and hips grow proportionally with the height; but the diameter of the chest, front to back, doubles toward the age of puberty. The change in relative proportions is shown by the fact that while at birth the point which divides the total height into two equal parts is a little above the navel, this point gradually sinks until in adult man it is about half an inch below the pubes, and in woman a little above. The lower extremities are about five times their length at birth. The arms are about four times the birth length. Probably one of the most careful series of measurements in this field is that of Dr. Landsberger of Posen. Dr. Landsberger measured in 1880, 104 children, and continued these measurements annually for seven years.

Vierordt (^{†⁹³}) gives the following table of lengths from computation of various measurements, showing the growth of various parts of the body, the size at birth as unity. Thus, taking the first line to illustrate, the child's head grows in length during the first 21 months of life half its length; at the end of seven and one-eighth years, 91.7 per cent. and at maturity the head is twice as long as at birth.

	Birth.	End of 21st Month.	Seven one- eighth Years.	Adult.
Length of head,	100	150	191.7	200
Upper part of head,	100	114	150	157
Length of face, From chin to upper end of breastbone,	100	200	250	260
100	500	700	900	
Breastbone,	100	186	300	314
Abdomen,	100	160	240	260
Leg,	100	200	455	472
Height of foot,	100	150	300	450
Upper arm,	100	183	328	350
Forearm,	100	182	322	350

Theory of Compensation. In the suggestion of Dr. W. S. Hall and Malling-Hansen (see pp. 299-301), that growth in height

(⁹³) P. 272.

during the resting period of growth in weight is at the expense of the latter, we have the suggestion of an important theory of the process of development which will appear in the treatment of later forms of growth, more especially in the psychic field. It might aptly be called the theory of compensation, and perhaps may be regarded as the antithesis of growth by parts. In the lower metazoic forms of life we find a colony of cells or group of cells, each an individual, as it were, capable to all appearance of practically all the functions of the whole. A bit of begonia leaf will reproduce the entire plant; if we section a centipede into parts, each part to a limited extent is capable of doing business on its own responsibility. Weismann's great attack upon the doctrine of transmission of acquired characters depends upon the contention that the reproductive cells are absolutely independent of all other parts of the body (except in conditions of nutrition), thus preventing peculiarities acquired during the life of a parent to be transmitted to offspring. In the human body the digestive system to a great extent is an independent organism supplied with its own nervous system and capable, up to a certain limit, of performing its duties without the interference of other parts of the body. Flechsig[†] has shown that in the development of the nervous system there is a growth by parts. The different strands of fibres in the spinal cord, and the fibres leading to different areas of the brain, commence their growth at certain specific periods, and grow in seeming independence of one another. We have here the theory of parts. Now, in how far is this true as a general principle of growth? In how far may we regard growth as a process dependent upon processes and functions contained within the part concerned? In how far does the growth of one part depend upon functions in other parts? We do know that, past a certain limit, the digestive system is essentially dependent upon other systems; that defect in blood supply affects every part of the organism. But in how far does the growth of the legs affect growth of lung capacity, the development of the brain centres of hearing affect the brain centres of sight, favorably or unfavorably; or, to go further, in what way does the exercise of the physiological factors concerned in memory affect those concerned in what we call reasoning? These are far-reaching questions, and as yet there is no answer whatever to them. On the one hand we have inferences that to a certain extent, and probably to a greater extent in some parts than in others, these parts are independent organisms, governing their growth and

[†]Die Leitungsbahnen im Gehirn und Rückenmark. Leipzig, 1876.
Also Gehirn und Seele. Leipzig, 1896.

exercise by forces resident within themselves as individuals. On the other hand we have inferences of the principle of compensation by which each part is dependent upon other parts, at least for certain services, and to some extent governing other parts. Does growth in height, for example, borrow the food supply which the forces of weight have stored up? Is this loan compensated to weight in some way, so that without an advance in height there is no extension in weight or an impairment of it? Existence and growth by parts and by compensation are correlative and opposing theories of significance, not only to biology, but to education at every step.

The determination of these principles, growth by parts and compensation and their relative scopes of activity, underlie the crucial problems of growth and education.

Persistence of Growth. There is a tendency to establish as a principle that each individual organism strives to reach some size particular to that individual. If disease in any way interferes with this progress in its natural course, the organism later seems to make redoubled growth to make up for the accidental loss. Pagliani^t points out this fact in the surprising recovery of children placed under favorable nutritional conditions after a period of poverty. It is a general fact of medical observation that sickness in growing children is accompanied by a loss in weight and retardation in height, and that, seemingly in consequence, convalescence is followed by very rapid growth, apparently indicating that the organism is striving to make up for the loss. Minot (¹⁷⁰) has shown this in his experiments with Guinea pigs, and he concludes from a significant array of facts that "each individual appears to be striving to reach a particular size. The fact, which I have thus expressed, is that if an individual grows for a period excessively fast, there immediately follows a period of slower growth, and *vice versa*; those that remain behind for a time, if they remain in good health, make up the loss (at least in great part if not always completely) soon after. Indeed, to permanently dwarf a Guinea pig requires an astonishingly prolonged interference; thus a young pig may lose one-third of its weight from a severe intestinal catarrh and yet make it up subsequently. The number of similar observations is so great that we might assert safely that a pretty severe and prolonged illness will not affect very much the ultimate size. It is probable that the same is true of man, and that, therefore, the usual and even the severer illnesses of childhood and youth do not greatly affect the ultimate size of the adult." A

^tSo Sviluppo umano.

(¹⁷⁰) P. 134.

forceable illustration of this struggle, seemingly of internal and perhaps hereditary forces, to obtain for the individual a specific size, is offered by Camerer (²³), who found, as stated, that however different the diet by which infants during the first year of life were nourished, all of approximately the same weight at birth reached practically the same weight at the end of the first year; the curves, however, show significant fluctuations at times during the year, suggestive of a struggle of the internal forces of the organism to combat the unfavorable external influences.

Accelerated Growth in Large and Small Children. The contribution made by Dr. Bowditch (²⁰) in his application of the Galton method of percentile grades† to the heights and weights of Boston children is what seems to show that large children make their pubertal rapid growth at an earlier age than small ones (of the same age). The age at which the maximum yearly growth in height and weight is reached is distinctly earlier in the percentile grades (for the same age) representing the children who are taller and heavier. The range for the beginning of the prepubertal acceleration according to size is from 12 to 14 years in girls and from 14 to 16 in boys. Large boys grow at an accelerated rate longer, but not necessarily more rapidly than small boys; this phenomenon Bowditch does not observe in his data for girls. The law does not apply apparently to children under ten years. But the theory of large and small children rests upon the assumption that a child, who in a certain degree is larger or smaller than the mean of his age, maintains throughout this growth this degree of deviation, that the small child of one year of age is the small child of the next. Dr. Boas in two articles* has attacked this theory, and his argument seems convincing that such an assumption is untenable; for the small child of one age may be the large child of the next age. This criticism undermines the value of many of the conclusions drawn from Galton's percentile method of calculation.

Co-education of the Sexes. Growth, so far as height and weight are concerned, seems without sex conditions up to the period of prepubertal increase. Girls and boys grow practically at the same rate from birth to ten or eleven years of age, and the form of their curves of growth is practically the same. There are, it is true, some slight differences to be observed. The Swedish Commission has found that the growing female

†For explanation of this method see Francis Galton's "Natural Inheritance."

**Science*, Dec. 23, 1892, and March 1, 1895.

body reacts more strongly to outward influences than the male, and Schmidt, in his Saalfeld investigation, strongly corroborates this conclusion. He finds that boys grow more regularly than the girls, and this fact is amply borne out by a study of the fluctuations in the charts. However, as a rule, these conclusions apply more particularly to the adolescent period, and it is doubtful that they materially affect the period up to the prepubertal accelerations. These differences are not so significant as materially to modify the statement in its practical import, that children's growth until their eleventh or twelfth year is unsexed. With the beginning of the prepubertal increases and the concomitant changes, which the violent fluxes in height and weight indicate, the statement is reversed. These facts are of the greatest import to the solution of the problem of co-education of the sexes. We may easily conclude, with slight fear of contradiction, that so far as growth by height and weight indicates there is no reason for the separation of the sexes for the first four or five years of school life. Beyond this period there certainly are grave reasons for questioning the system of co-education, upon grounds of physical dissimilarities, not to discuss the mental dissimilarities of girls and boys of the same adolescent age. But the latter period belongs properly to the treatment of the adolescence. On the continent, the rule has been in the past generally in favor of separation, the tendency extending even to the primary classes. A reaction in all countries that have separated primary classes has recently set in, and the tendency toward co-education is extending upward through the grades. Burgerstein[†] concludes a succinct review of the co-educational problem and the recent reaction against the system in the primary schools: "So far as the data for decision of the question are concerned, the demand for the separation of the sexes has been made and accomplished on *a priori* grounds, but from practical experience the presumptive moral grounds are not as sound as they have hitherto appeared. This is true, at least, for the Volksschulen (primary school)."

Biological Considerations. Little has been accomplished thus far in conforming the phenomena of human growth to biologic laws. The modern theories of Weismann carried to their logical extreme would seemingly place this entire field of anthropometric phenomena in a new light. Dr. C. S. Minot, however, in one or two papers has made a preliminary contribution to this aspect of the problem. He gives to senescence the place of a positive factor which is struggling from birth

[†]Handbuch der Schulhygiene, Burgerstein and Netolitzky, pp. 226-30.

onward with the annabolic or up-building processes. In the earlier period of life, growth has the upper hand—the processes of annabolism do more work than those of senescence, which ever tend to tear down what the other has builded. Growth, Dr. Minot claims, is the product of four factors (⁶⁸): The rate of multiplication of cells, (2) the frequency of division, (3) the weight of cells, (4) the loss of cells. In the earlier periods of life, the multiplication of cells, the essential factor of growth, is so rapid that the increment of senescence is less than the increment of the number of cells. "At each division, therefore, the multiplication of the cells obtains the upper hand and the rate of growth increases; soon, however, the increment of senescence surpasses the increment of multiplication, and thereby renders the rate of growth less, until at last the excess of senescence becomes so great that growth ceases, or at least becomes so insignificant that it only serves to counterbalance the loss of cells." Some such principle established and applied to the fluctuations of growth offers a suggestive field of explanation.

The reaction of the reader of this field of investigation must be that of a sense of the extreme complexity of the problems involved. Every result is the product of several factors, and in each community these factors vary at least in the proportion of their mixing. Of the many studies made upon the same or allied problems, there are few that are directly comparable in close detail, so that for conclusions we must content ourselves with expression in the broadest terms until the stndies have been so multiplied and repeated under similar conditions that details may be compared. For example, in the matter of the relation of disease to growth, Hartwell in Boston deals with deaths from all diseases, Combe with acute complaints, and Warner with still another classification. The social environment, the school hygiene and climate are varying factors in each case. Moreover, Hartwell's calculations are upon the exact age in years, while Key's ages are obtained largely by averaging ages of the pupils in any school grade. Therefore each study must be taken to a large extent by itself. Further, for the immediate interests of psychology, none of these stndies have been carried far enough on psychological lines to satisfy the suggestions which they arouse. We want Dr. Hartwell to tell us the mental condition of these children who died—their relative mental strength compared with those who lived; we want to know from Key, Hertel, Combe and Schmidt-Monnard the mental conditions of those unhealthy school children compared with the healthy ones, so that we may estimate the actual effects and importance of health upon

the mental growth and power; we should like to know the comparative rate of progress of these two classes of children in school—the immediate mental effects of the different diseases upon the nervous system. But Key, Hertel, Hartwell and Schmidt-Monnard are physicians. They have seen these facts from the physician's more or less special standpoint. They have framed their tests accordingly. Is it not the high noon of urgency that the psychologist and pedagogue, from their apperceptive standpoints, were studying these conditions critically, applying their tests and framing courses of practical application? However, on the other hand, while these finer details have not yet been worked out, we are certainly ready to conclude from what all studies unanimously show, that there are rhythms of susceptibility to disease varying with the age of growing children. There are times when the organism is more liable to disease than at others, and the coincidence of these periods with periods of activity and rest in the growth, as shown by height and weight fluctuations, forcibly suggests an organic connection between disease and the growth of specific organs and parts of the body. While it is difficult to trace the details, nevertheless, it seems as though life were a specific thing, and when most active also most tenacious of its prerogatives. Dr. Warner also inclines strongly to the theory of a growth energy, which, when impeded in its natural metabolic functions, expends itself in some other channel, as likely to work harm as good. If this be true, what is the significance to the psychologist and pedagogue? If the function of the pedagogue is to develop the greatest amount of mental strength, then it behooves him to give part of his attention to the duty of obtaining for the nervous system of his pupils their fair share of this vagrant growth energy, so persistently and often mischievously seeking an employer. If disease not only checks nervous growth, but, coming at specific growing periods, permanently dwarfs certain areas of nervous action, then the loss of a Latin root or so is not to be compared with the loss of that which never can be replaced. What may be the factors upon which this development depends? If the body is an autonomous interacting democracy, as up to certain limits we clearly have a right to conclude, we cannot escape the conclusion that in disease of muscular tissue, nervous tissue must in some way be affected. Who can say at present how far-reaching and how permanent may be the effects upon a brain in its nascent period, of an affection outwardly manifested by a simple headache? In Denmark and Sweden we find that between 30 to 75 per cent. of the children in growing ages are affected by chronic diseases alone. In America no such investigation has

ever been made. We have reason to suppose that the percentage must be much less. If true, are the children living in America mentally stronger? Have we a right to give them stronger school work? Can we still lessen the amount of disease, and in how far may we thereby develop men and women stronger intellectually? The study of these facts but starts up suggestions of problems, as sharply important to the parent, pedagogue and psychologist as to the physician. The ground has scarcely yet been broken, and the pioneers who have been cited cannot begin to answer the practical questions of pedagogy and psychology which impatiently demand an answer.

From the studies in nutrition it is shown that the child of favorable conditions, at any given age, is very significantly heavier and taller than the child of unfavorable nutrition and social life. What does this additional height and weight of the favored class signify—merely increments of bone and muscle? Here, then, is unquestionably also a new province for psychology. The anthropometrist has merely given us an unhusked fact, stating that lack of nutrition stunts growth, without telling how much of this loss belongs to muscle, how much to nervous tissue. It is impossible to speculate clearly before we know more of the factors involved, and the psychologist, if he expects psychological results, must take off his coat and investigate for himself. We do not know clearly at what periods of growth effects of mal-nutrition are most pronounced. The evidence wavers between the period before puberty and the period during puberty. If before, what shall we say of possible permanent dwarfing of brain power in that nascent period of rapid growth up to the eighth year, before the brain is said to reach its maximum weight. Roberts has data which seem to indicate that children stunted by unfavorable conditions make permanently smaller men and women. Does this stunting not affect the mental power? This does not mean to imply that small men are mentally duller than big men, for we have seen that there seems to be for every individual his particular size, and to attain which every organism seems to make a significantly desperate struggle. The problem seems, not how to make the child grow big, but how to keep the track clear so that each organism may obtain its particular size. Brer Rabbit, though smaller, is quicker witted than Brer Fox, it is true, but there is no telling how untimely would have been the fate of Brer Rabbit had he been stunted in his early infancy and prevented from reaching his diminutive but particular size. It is a singular fact that the members of the Royal Society of England average taller than any other class of men. Throughout, the professional classes

are distinctly taller than those of the lower classes. What factors are involved? If race is the single factor, then the matter is of least theoretical interest to psychology, but if, as the facts which have been reviewed seem to indicate, nutrition, freedom from accidental disease and social environment are also essential factors, then the facts become of crucial importance to pedagogy and psychology on practical grounds.

Dr. Porter has thrown down the gauntlet resonantly, in the conclusion from his data that among children of the same age, the taller and heavier are more precocious. His facts seem to decide at once that increments of height and weight imply increments of those nervous tissues which make for mental acuteness. Dr. Porter has been sharply reviewed. Dr. West, upon the basis of another test, declares the direct contrary. There are three conclusions involved in the form in which Dr. Porter sums up his evidence: (1) That there is a relation between size and mental activity, (2) that size is the direct causal precedent to mental condition, (3) that large size is the cause of precocity. It is clear at once that the second and third conclusions may be quite wrong, and yet, the first remaining, the data with which he deals are psychological in character. It may be true that Dr. Porter is wrong in finding that precocity accompanies large size—it may be an accompaniment of small size. Or, as Dr. Boas criticises, Dr. Porter may be wrong in concluding that the height and weight are the material causes of mental acuteness, and yet these two effects may proceed from a common cause. It may be, for example, that these precocious children enjoyed better nourishment, and the food supply contributed to build up both muscular and nervous tissues at the most favorable periods and under the most favorable conditions. Or, as Dr. Boas also criticises, the facts Dr. Porter presents may be accounted for on the assumption that children who are taller and heavier are so because they have escaped diseases and the organism has had opportunity for free growth, nervous as well as bony and muscular. But neither criticism vitiates the facts for the psychologist, for both emphasize the importance of the physical conditions of nutrition and freedom of disease as factors directly or indirectly making for intelligence. Dr. West, in his preliminary report upon the Toronto investigation, states that the results are just the reverse of Dr. Porter's conclusion. The large children are duller and the small children more precocious. We have here, then, a direct contradiction, though from the standpoint of different tests.

Dr. Gilbert's studies in Iowa and New Haven and Dr. West's Toronto study are hardly comparable. A teacher's

judgment is as questionable as the test of promotion, and, further, this judgment only speaks for the present. It may be the present is the child's period of rapid growth, or the period of slow growth. Dr. Gilbert and Dr. West should tell us whether, at the time the teacher's judgment is made, the child is growing rapidly or slowly. Dr. West points out that some children enter school a year or two later than usual, and, being older, are therefore taller and heavier, and consequently these children tend to raise the averages of the larger children in each grade. This is undoubtedly a factor of error, but, on supposition, it can hardly be concluded there are so many children who enter school late as to affect all these results so materially as to overthrow them. None of these criticisms can be substantiated by mere argument. We must have duplicate tests made, and tests made from a psychological standpoint with attention to these disputed factors. We need supplementary data on Dr. Porter's study to tell us the age of children entering school, the course of health and nutrition of the large and small classes, the teacher's judgment at periods of rapid growth and periods of slow growth. Not until then can we determine the more exact relations. But this is work for the psychologist. From the standpoint of general experience, it would be singular if Dr. Porter's conclusion is sustained. The stunted tree fruits earlier. The starved street gamin is more precocious than the well-groomed child enjoying four meals a day and growing *ad libitum*. Mr. Bohannon* in his studies of exceptional children finds that large children naturally associate with children older than themselves, and small children with those younger than themselves; it may be consequently that we must reckon with the effects of this factor in considering the precocity of large and small children.

One chief pedagogical problem to be solved is whether children are able to do their best mental work in their growing periods or in their periods of rest from physical growth. We have seen that, on the whole, the period from 6 to 10 or 11 years in girls and from 6 to 12 in boys is a period of general decreases in the rate of growth. Perhaps in the earlier portion of this period, there is a slight increase, but the latter two or three years are undoubtedly one of inactivity of the processes which make for bodily growth. From the pre-pubertal acceleration in the 11th or 12th to the 15th year in girls and from the 12th or 13th to the 17th in boys, we have tumultuous changes and rapid growth. Now, shall we say with Key and Hartwell that the periods of most rapid growth

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are the periods of greatest resistance to disease,—and, inferentially, that the same periods are those in which the child is most active mentally? Shall we say with Porter that the taller and heavier a child is for his age, the brighter he is mentally,—and, inferentially, that the periods of rapid growth are the periods when he is most capable of mental work? If we are satisfied with the evidence and inference, then the period from entrance in school until the prepubertal acceleration is one of comparative mental inertia, while the period of puberty is the time *par excellence* for the strain of school work. Or, from the same data of growth rate, shall we not invoke the theory of compensation and conclude that when the child is growing fastest in bone and muscle tissue, therefore he is resting mentally: that, therefore, the period before the prepubertal increase is the true period for mental activity and the period of active pubertal growth the time for mental rest. A third alternative view is offered by the theory of growth by parts. In the light of this theory, we would conclude that the nervous and muscular systems are to a considerable extent independent systems, and the periods of rest or growth in one have no important and immediate influence upon the other. If we take this view, then we must next consider the growth of the nervous system. This subject must be treated in a subsequent chapter.

Shall we not say in conclusion, then, that this new territory, the problem of growth, is properly a province of psychology? A surgeon's knife and saw have transformed feebly-gifted children into children with normal intelligence. The alienist, from the insane ravings of his patient, has, in some forms of the affection, been able to declare in advance of autopsy the anatomical situation of disease—a lesion in that area, a blood clot in this. The old psychologist is forced to admit that, in certain particulars at least, the physical modifies and conditions the mental, but he hastens to pass by these facts with averted eye as minor details, exceptions, apocrypha, matters for foot-notes and appendices. On the contrary we have before us some vitally important problems in pressing need, upon practical grounds, of early solution. Has the time not come, as when the child, become man, puts away his childish things, so the psychologist may leave to the gymnastic and disciplinary period of his training the old enigmas which require for their solution the complete explication of God and cosmos? Is the time not here when the psychologist may not legitimately push out inquiry into the domain concerned with the modification of the growing mind by sex, race, nutrition, disease, and by rapid and slow rates of metabolism?

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ages, grouped by ages according to height. A comparison is made between the heights at the different ages of the children in the Freiberg Bürger school and those of the peasant classes in the outlying towns and the results showing a greater average height of the former at a given age, are given in tables and also graphically. In addition there is a careful mathematical study of the probable error involved, concluding that the arithmetical average is not suitable for practical application and offering a formula for correction.

43. GEISSELER, DR. MED. ARTHUR. Medezinalrat in Dresden. *Messungen von Schulkindern in Gohlis-Leipzig. Schulgesundheitspflege*, 1892, No. VI, pp. 249-253. The study deals with the height of 2,806 children, 1,386 boys and 1,420 girls; and the weight of 2,802 children, 1,385 boys and 1,417 girls. The investigation was undertaken at the close of the summer vacation in 1889. He discusses the difference between children of the favored and unfavored classes, giving brief data.

44. GILBERT, J. ALLEN. Researches on the Mental and Physical Development of School Children. Studies from the Yale Psychological Laboratory, Vol. II, 1894, pp. 40-100. The matters experimentally investigated are as follows: muscle sense, sensitivity to color differences, force of suggestion, voluntary motor ability, fatigue, weight, height, lung capacity, reaction time, and time memory, precocity and dullness. The children measured were New Haven (Conn.) children, 6 to 17 years inclusive; 602 boys and 584 girls. Approximately fifty children of each sex and for each age were thus tested. Shoes were worn. Dr. Gilbert's tables give the heights, both in centimeters and inches; the columns give weight of both sexes; statistical mean variation for the same; height of boys for each age; statistical mean variation for boys; height of girls for each age; statistical mean variation for girls; height of children denominated "bright" by their teachers; height of children denominated "average" and height of children termed "dull;" and also the number of each sex at each age. Two curves are separately charted; first, the curve of growth by girls and boys and by each sex separately; secondly, the statistical mean variation for both sexes and then each separately. The tables for the other tests give about the same detail.

45. GILBERT, J. ALLEN. Researches upon School Children and College Students. University of Iowa Studies in Psychology, Vol. I, pp. 1-39. Dr. Gilbert repeats upon pupils in Iowa schools and students in the University of Iowa some of the experiments performed upon New Haven children, as stated in No. 44. Some new lines of investigations are worked out; the data upon dull, mediocre and precocious children are much fuller. The tests taken are as follows: (1) pulse, both before and after the series of tests; (2) pain threshold; (3) strength of lift with the wrist; (4) strength of lift with the arms; (5) estimation of length by arm movement; (6) estimation of length with the eye; (7) lung capacity; (8) weight; (9) height; (10) voluntary motor ability. The number of subjects is approximately fifty at each age for each sex. Tables segregated for age and sex, and curves for both the experiment itself and the mean variation of both sexes are given for each test. All tables segregate the dull, mediocre and precocious children, so that comparison is easy. The curves for dullness and precocity are also given in the cases of weight, height, lung capacity, voluntary motor ability and fatigue.

46. GOULD, B. A. Investigations in the Military and Anthropological Statistics of American Soldiers. U. S. Sanitary Commission, N. Y., 1869.

47. GREENWOOD, J. M. Heights and Weights of Children. Report of Board of Education of Kansas City Schools, 1890-91; American Public Health Association Reports, Vol. XVII, pp. 199-204.

48. HALL, WINIFRED S., PH. D., M. D. Changes in Proportions of the Human Body During the Period of Growth. *Journal of Anthropological Institute of Great Britain and Ireland*, Vol. XXV, 1895, pp. 21-46. Dr. Hall was medical examiner at Haverford College, 1889-93, and also examined the boys of three Friends' grammar schools. The data present great homogeneity as to race, nationality and social conditions. The ages concerned are from 9 to 23 years. The measurements taken are: height; height of hip, knee; girth of head, neck, chest at nipples, ninth rib, abdomen; circumference of hips, thigh, knee, calf, ankle, upper arm, elbow, ankle, forearm, wrist; depth of chest, abdomen; intercranial breadth; length of upper arm, forearm, hand, foot; weight (nude); lung capacity; strength of back, thigh, pectoral muscles, forearm, upper arm. Important conclusions are reached relative to strength.

49. HANSEN. Ueber die Individuellen Variationen der Körper Proportionen. *Archiv. f. Anthropol.*, Bd. XX, p. 321.

50. HARTWELL, E. M. Report on Physical Education in the Boston Public Schools, 1894.

51. HERTEL, DR. AXEL. The Danish Commission was appointed in 1882 and investigated the health of 17,595 boys and 11,646 girls, partly in the higher schools, partly in Volksschulen, both in Copenhagen and in the country. The matters considered were: age, length of work, time at school and at home, height, weight, and diseases, chiefly scrofula, anaemia, nervousness, headache, nosebleed, chronic indigestion, chronic lung and heart complaints, spinal curvature, and other chronic diseases such as those of the kidneys, joints, etc. Since both higher and Volksschule pupils were investigated, the report treats of the effects of social environment. The results of this commission, those of the Swedish Commission, and of his own are reviewed and discussed by Hertel.

52. HERTEL, DR. AXEL. In 1881 Dr. Axel Hertel, Kommunaler Kreisarzt in Copenhagen, published (in Danish) a report of an examination of growth he had made upon 3,141 boys and 1,211 girls, all pupils in the higher schools of Copenhagen. The report showed the growth and prevalence of chronic diseases among children for different ages. The information was obtained from the parents and family physicians. The results of this study will be found briefly reviewed in an article by Dr. Hertel (see No. 53). An English translation of Hertel's book by Godfrey Sörenson is published by Macmillan, 1885, under the title of "Overpressure in High Schools of Denmark."

53. HERTEL, DR. AXEL. Neure Untersuchungen über den Allgemeinen Gesundheitszustand der Schuler und Schulerinnen. *Schulgesundheitspflege*, 1888, Nos. 6 and 7, pp. 167-183; 201-215. This is a review and comparison of the result of his own, of the Danish Commission's and the Swedish Commission's investigations upon the age, height, weight, and chronic diseases of children between 6 and 17 years of age. He charts the curves of the per cents. of diseases at various ages, and discusses the results in their relation to age, physiological conditions, school and home duties. In the second article he gives the chief tables of the two commissions and discusses the problem of school hygiene from this standpoint. The most important contributions of the Danish and Swedish Commissions are here reviewed, and the most valuable of the tables are reproduced.

54. HESS, W. Bestimmungen des Gewichtes und Messungen

der Körperlinge bei einem Kinde im ersten und zweiten Lebensjahr. *Archiv. f. Gynäkologie*; Berlin, 1881.

55. HITCHCOCK, E. Physical Education, London, June, 1891.
56. HOLMES, B. Study of Child Growth. *Intelligence*, Vol. XIV, p. 323.
57. HUDSON, G. H. Phenomena of Child Growth in Education. *Education*, Vol. XIV, p. 466.

58. KEY, AXEL. Läroverkskomitén Betänkande III. Bilage E. Kongl. Boktryckeriet. Stockholm, 1885, 2 vols. The work is edited in German, somewhat condensed, by L. Burgerstein, under the title, "Schulhygienische Untersuchungen, Hamburg and Leipzig, 1889." This constitutes the report of the Swedish commission of which Axel Key was the head, appointed in 1882 by the government to investigate the hygienic conditions of the schools. The report deals with data from 15,000 boys of the Swedish middle schools and 3,000 girls in private schools. The original contains a volume exclusively devoted to elaborate tables and curves. The greater portion of the report is occupied by hygienic investigations, shortsightedness, influence of work upon health, possibilities of instruction, sleep, relation between health and hours of sleep, conditions of home surroundings, etc. A chapter, however, is devoted to the development in length and weight at different ages from 6 to 20, boys and girls. The most signal contribution of the report is that showing the relation of disease to the periods of rapid and slow growth. The results of the Swedish commission are compared and discussed by Dr. Axel Hertel. (See No. 53.)

59. KEY, AXEL. Die Pubertäts Entwicklung, Verhandl des Internat. Med. Congress zu Berlin, Bd. I, 1890, p. 67 *et seq.*

60. KOTELMANN, DR. L. Med. u. Phil. Die Körperverhältnisse der gelehrten Schüler des Johanneums in Hamburg. Zeitschrift des Königlichen preussischen statistischen Bureaus, Jahrgang, 1879. This is a very careful study upon 515 boys, 10 to 15 years of age, giving accurate data upon growth in height, weight, strength, lung capacity, vital force, etc.

61. VON LANGE, EMIL. Die Normal Körpergrösse des Menschen, München, 1896.

62. LIHARZIK, F. Das Gesetz des Wachstums und der Bau des Menschen, etc., Vienna, 1862.

62. LANDSBERGER, DR. Prakt. Arzt in Posen. Das Wachstum im Alter der Schulpflicht. Archiv für Anthropologie, Vol XVII, pp. 229-264. This is a study upon the individual plan. Dr. Landsberger measured a number of children from 1880-1886, partly of German and partly of Polish parentage, partly of the favored class and partly of the poorer classes. There were originally 104 children, but the number fell off from year to year, and in 1886 there were but thirty-seven remaining. The measurements are from 6 to 13 years of age. In addition to height there were twenty-four other measurements: Distance from finger-tip to finger-tip with arms outspread, height of left shoulder, right shoulder, middle finger-tip, height of hip bone and of knee, length and width of skull, circumference of neck, length of breast bone, circumference at breast, circumference at navel and others. He discusses the differences in height relative to race, obtaining negative results; with reference to effects of nutrition, disagreeing with Bowditch that race is a more important factor than nutrition. A table at the close gives in detail the measurements by years. Each series of measurements is discussed with care and in comparison with the results of other investigators.

64. MALLING-HANSEN, P. Perioden im Gewicht der Kinder und in der Sonnenwärme, Kopenhagen, 1886. The contents of this book

are summarized in this article. An accompanying volume of charts illustrates graphically the tables of growth.

65. MALLING-HANSEN, PASTEUR R., Directeur de l'Institution. Einige Resultate der täglichen Wägungen von 130 Zöglingen des Königl. Taubstummen-Instituts in Kopenhagen. Congrès Périodique International des Sciences Médicales. Copenhagen, Vol. III, pp. 103-119. The first portion of this address covers the matter of seasonal periods and weekly, more extensively and carefully treated in his later publication (No. 64). The latter part deals with an experiment upon a change of diet in the institution, and shows the effect of good nutrition and the fact that improved food affects growth in weight only at certain definite times of the year. The facts are graphically illustrated by nine charts.

66. MALLING-HANSEN, PASTEUR R. Ueber Periodicität im Gewicht der Kinder an Täglichen Wägungen. Fragment I, Copenhagen, 1883, p. 35. This monograph is a brief preliminary report upon the observations more extensively treated in No. 64. It deals chiefly with the seasonal periods of growth, the daily variations due to atmospheric temperature.

67. MEEK, K. Volummessungen des Menschlichen Körpers und seiner enizelnen Theile in den verschiedenen Alterstufen. Zts. f. Biologie. München und Leipzig, 1894, pp. 125-47.

68. MINOT, DR. C. S. An article in Harvard Medical School Laboratory Papers (1873-9) upon the biological factors of growth.

69. MINOT, DR. C. S. Human Growth, *Boston Medical and Surgical Journal*, July 22, 1880.

70. MINOT, DR. C. S. Senescence and Rejuvenation. *Journal of Physiology*, Vol. XII, pp. 97-153, 1891.

71. MIWA, NORIHIVA, M. D. A study upon weights from 3 to 80 years of age. *Tokio I-Gaku-Kwai-Zatumshi*, Vol. VII, No. 9 (May 5, 1893), Japan.

Dr. Miwa gathered data from the kindergartens, higher schools, colleges and other sources. He deals with the problem of maturity in growth, and also, to a limited extent, with the weights of different classes of society. In the tables given the number of persons examined is generally from 150 to 230 for ages between 6 and 20 years.

72. MOON, S. B. Measurements of the boys of the McDonough School, for years 1888-91. McDonough School, Maryland, 1892.

73. MOULTON D. Body Weight and Mental Improvement, *American Journal of Insanity*, October, 1894.

74. PAGLIANI. Die Entwicklung des Menschen in den der Geschlechtsreife vorangehenden späteren Kinderjahren und in Jünglingsalter von 7 bis 29 Jahren. Other publications by Pagliani are not available, except in Italian (for titles, see bibliography given by Dr. Porter, Growth of St. Louis Children). Pagliani investigated the height, weight, lung capacity and muscular force of children, boys and girls, 7 to 18 years of age, of Turin, Italy. He considered the effects of good and poor nutrition, giving tables of rate of growth of school girls under favored conditions and corresponding facts concerning a number of charity girls. He also gives statistics upon the effects of exercise upon the development of lung capacity of boys.

75. Oakland (Cal.) School Report, 1892-93. In 1892 about 6,000 children, 6 to 18 years, were weighed and measured under the direction of the University of California and Stanford University. A part of this data was collated. The study is in reprint form and gives tables and graphic charts of height and weight.

76. PECKHAM, GEO. W., M. D. The Growth of Children. Sixth

Annual Report of the State Board of Health of Wisconsin. The study was undertaken in 1881 in the public and various private schools of Milwaukee. It consists of data of about 10,000 children, from 4 to 18 years, arranged much on the same plan as that of Dr. Bowditch's study (No. 18). There are eleven plates and thirteen tables segregating the rates of growth by nationalities. Among the topics treated is that of the relative reliability of the arithmetical averages and medium values, variations of growth by influences of sex, race, climate, density of population, relation of growth of body and lower extremities.

77. PORTER, W. T. Relation of Growth of Children and their deviation from the physical type of their sex and age. *Trans. Acad. Sci. of St. Louis*, Vol. VI, No. 10, 1893.

78. PORTER, DR. WILLIAM TOWNSEND. Growth of St. Louis Children. Issued as a report of the Academy of Science of St. Louis, Vol. VI, No. 12, pp. 263-380. This is the result of the study of 34,354 children; 16,295 boys and 18,059 girls of St. Louis, taken in 1892. It embraces data of age, sex, occupation and nationality of parents, height standing, weight sitting, span of arms, strength of squeeze, girth, weight, measurements of face and head. The first portion of the report is occupied with a statement and discussion of the statistical methods employed and mathematical consideration of probable error, the median or average, etc. Among the many subjects treated are: The influence of occupation and nationality of parents, sexual differences of growth, application to individual children of the mean values. There are fifty-one tables largely in percentile grades and thirty-four plates illustrating graphically the facts shown by the tables. An index and a comprehensive bibliography are inserted.

79. PORTER, DR. W. TOWNSEND. The Physical Basis of Precocity and Dullness. *Transactions of the Academy of Science of St. Louis*, Vol. VI, No. 7, pp. 161-181. Reprint issued March 21, 1893. The conclusions of this study are derived from the data of Dr. Porter's Growth of St. Louis Children (see No. 78), and is, therefore, based upon investigations of 34,500 boys and girls, 6 to 17 or 18 years of age. The thesis he advances with much certainty is that "precocious children are heavier and dull children are lighter than the mean child of the same age." For the purpose of establishing this principle he gives fifteen tables and two plates tracing the development by age of dull, mediocre and precocious boys and girls.

80. QUETELET, A. *Anthropometrie*. Brussels, 1870. The data of Quetelet are inserted merely for their historic value and for reference. They have little scientific value, physiological or statistical, since they are averages from but ten individuals of each age and these were first "selected."

81. RÖTZ. *Grundzüge d. Physiologie; Pathologie und Therapie des Kindesalters*, 1883, p. 22 (deals with growth from birth to sixth year).

82. ROBERTS, CHARLES, F. R. C. S. *Manual of Anthropometry*. London, 1878. This is probably the most general and complete treatment of growth measurements in English. It deals with the methods of anthropometric study and apparatus; and contains numerous tables and an excellent bibliography up to the date of publication. Among the more important tables are those showing the height, weight, and annual rate of growth of 7,709 boys and men between the ages of 10 and 30 years of the most favored classes of the English population, public school boys, naval and military cadets, medical and university students; a similar table showing the empty chest girth of 5,915 boys and men, 12 to 30 years, of the

same class; a table showing the height, weight and chest girth of new-born infants of the artisan class; tables of actual, average and mean height, weight and chest girth of 13,931 boys and men between the ages of 4 and 50 years of the artisan class; a table from Dr. Bowditch of Boston showing the actual, mean and average weight of 10,904 American girls between 5 and 19 years; tables giving the average height and weight of 54,447 boys and men of all ages to 50 years, English population segregated according to classes as follows: professional, commercial, laboring, industrial, idiots and imbeciles, also the same data for 4,630 Boston boys from the favored class quoted from Dr. Bowditch. All of these tables segregate the data according to age. The volume also contains plates, charting certain facts given in the tables, and also one charting the relative growth from year to year of the different parts of the body, head, neck, chest, abdomen, thigh, leg and foot.

83. ROBERTS, CHARLES, F. R. C. S. Memorandum on the Medical Inspection of, and Physical Education in, Secondary Schools. Report of the Royal Commission on Secondary Education of England, Vol. V, p. 352-374. The report deals chiefly with hygiene, death rates at various ages, size in relation to intelligence, weight, height, physical education, etc.

84. RUSSOW, A. Vergleichende Beobachtungen über den Einfluss der Ernährung mit der Brust, u. d. Kunstlichen Ernährung auf das Gewicht und Wuchs (Länge) der Kinder. Jahrb. f. Kinderheilkunde, Vol. XVI, pp. 86-132, 1880-1.

85. SCHMIDT, EMIL. Die Körpergrösse und das Gewicht der Schulkinder des Kreises Saalfeld (Herzogthum Meiningen). Archiv. f. Anthropologie, Vol. XXI, pp. 385-434 (1892-93). In the city of Saalfeld on June 1, 1889, 9,506 children, 4,699 boys and 4,807 girls, from 5 to 14 years, were measured and weighed. Herr Schmidt devotes much space to comparing these heights and weights with the results of other studies, those in Freiburg, Gohlis, Posen, Breslau, Hamburg, Boston, England and Turin; a second part is taken up with a comparison of the children of Saalfeld city with those in the outlying country, data of which are given; a careful study in detail is also made of each district. The study is replete with tables.

86. SCHMIDT-MONNARD, KARL. Die chronische Kränklichkeit in unseren mittleren und höheren Schulen; XII internationalen Med. Kongress zu Moskau, 1897; also Zeitschrift f. Schulgesundheitspflege, 1897, Nos. 11 and 12, pp. 593-620, 666-685. Dr. Schmidt-Monnard has in this study made a valuable and elaborate contribution to the literature of hygiene of the middle and higher schools from data he has collected in Halle. He investigated 5,100 boys and 3,200 girls in the higher and middle schools, relative to the prevalence of chronic diseases, headache, nervousness, chlorosis, sleeplessness, indigestion, loss of appetite, nose bleed and eye troubles. He considers the problem of sex, finding boys less susceptible to disease than girls; the conditions of various classes of school, the hygiene of their requirements and the data class by class; effects of home duties; the amount of sleep at various ages, effects of fatigue observed. He gives a number of charts, and a few tables, some of which deal with effects of vacation colonies and the growth in height and weight of individual children through the 14th year.

87. SHUTTLEWORTH, DR. G. E. The Health and Physical Development of Idiots Compared with Mentally Sound Children of the Same Age. Proc. of Association of Medical Officers of American Institutions for Idiotic and Feeble-minded Persons, 1876-86, pp. 315-322.

88. SULIGOWSKI, DR. FELICIAN. (Anthropometric measurements of children in the gymnasium for boys at Radom, Russia.) Medycyna, Tome XV, p. 512. Warsaw, 1887. Dr. Suligowski gives data upon 1,133 males, 9 to 21 years of age. The investigation deals with statistics upon height, weight, expansibility of the chest, power of sight, color of hair, traces of crookedness on the breast, increase of lymphatic tonsils on the neck.

89. TARRELL, DR. G. G. On the Height, Weight and Relative Rate of Growth of Normal and Feeble-minded Children. Proceedings of the Association of Medical Officers of American Institutions for Idiotic and Feeble-minded Persons, 1876-86.

90. TOPINARD, PAUL. Etude sur la Taille, considérée suivant l'âge, le sexe, l'individu et les races.

91. TOPINARD, PAUL. Anthropology translated by R. T. H. Bartley, M. D. Philadelphia, 1878.

92. VAILL, DR. M. (Director of the Girls' School of Jägerpris in Denmark.) Mittheilungen über das Gewicht nichterwachsener Mädchen. Congrès Périodique International des Sciences Médicales, Copenhagen, 1884, pp. 120-125. The school is for poor girls. The children vary in age from 4 to 16 years. They were weighed twice a year from 1874 to 1883, on April 1 and October 1. Tables are given of the yearly and half yearly weighings, and the increases, showing a larger growth in the summer half year than in the winter half year. A brief statement of his results with table will be found in the Burgerstein-Key Hygienische Untersuchungen, pp. 244-245 (No. 58).

93. VIERORDT, K. Physiologie des Kindesalters; Gerhardt's Handbuch der Kinderkrankheiten, Bd. I, pp. 228-36.

94. VIERORDT, K. Anatomische, Physiologische und Physikalische Daten u. Tabellen.

95. VIERORDT, K. Grundriss der Physiologie des Menschen. Tübingen, 1871.

96. VILLERME. Annales d'Hygiène, Vol. I, p. 359.

97. VOIT, DR. C. Ueber die Periodicität im Gewicht der Kinder, 1885.

98. WARNER, DR. FRANCIS. Report to the British Medical Association and Charity Organization Society of London on the Physical and Mental Condition of 5,000 Children seen in 106 Schools of London. Reprinted in the Report of the Commissioner of Education (U. S.), 1890-1, Vol. II. See also Bibliography No. 109.

99. WARNER, DR. FRANCIS. Study of Children, 1897.

100. WARNER, DR. FRANCIS. A Method of Examining Children in Schools as to their Development and Brain Condition. *British Medical Journal*, Sept. 22, 1888.

101. WEST, GERALD M. Worcester School Children, the Growth of Body, Head and Face. *Science*, Vol. XXI, Jan. 6, 1893. The investigator weighed and measured 3,250 individuals, 5 to 21 years, in the public and private schools of Worcester, Mass. He gives curves (not tables) and discussion of weight, height, width of head, length of head, sitting height, index of sitting height, proportion of breadth of face to breadth of head, etc.

102. WEST, GERALD M. Anthropometrische Untersuchungen über die Schulkinder in Worcester, Mass. Archiv. f. Anthropologie, Vol. XXII, pp. 13-48, 1894. The study here detailed is a much more complete report than that given in *Science* (No. 101), though dealing with the same topics. There are given twenty-one tables and five chart curves.

103. WEST, GERALD M. Observation of the Relation of Physical Development to Intellectual Ability Made on the School Children

of Toronto, Canada. *Science*, N. S. IV, 1896, pp. 156-159. This is a preliminary report to a contribution not yet completed. The writer discusses the conclusion of Dr. Porter in St. Louis that children taller and heavier are more precocious than their lighter and shorter fellows of the same age. He reaches a diametrically opposite conclusion. The basis for determination of precocity is the teacher's judgment, while in St. Louis the basis was the school grade in comparison with age. Dr. West gives no figures, but a curve showing the relative size of "good" and "poor" students.

104. WEST, GERALD M. Address in Proceedings of the International Congress for Anthropology, Chicago, 1893.

105. WIENER, DR. CHRISTIAN. *Das Wachstum des menschlichen Körpers* (in Vorträge Gehalten im Naturwissenschaftlichen Verein zu Karlsruhe). Karlsruhe, 1890. This is a brief monograph giving the yearly heights and head measurements of Dr. Wiener's four sons from birth to maturity. Tables and curves are furnished and it forms a contribution of its kind of great value.

106. WINDLE, B. C. A. Anthropometric Work in the Schools. *Medical Magazine*, London, 1894, pp. 631-649.

107. WRETLUND has weighed the pupils of the girls' school in Gothenberg (Denmark) at the beginning and end of the school year (September and June). His results were printed at Eira in 1878, in Danish. A review of essential results and tables will be found in the Burgerstein-Key *Schulhygienische Untersuchungen*, pp. 240-242 (No. 58). Wretlind attempts to show that school work retards growth.

108. ZACHARIAS, O. Ueber Periodicität in der Gewichtzunahme bei Kindern; Monatl. Mittb. a. d. Gesamtgeb. d. Naturw. Berlin, 1889.

109. Report on the Scientific Study of the Mental and Physical Conditions of Childhood; with particular reference to children of defective constitution, and with recommendations as to education and training; based upon the examination of 50,000 children seen in 1888-91 and another 50,000 seen in 1892-4; published by the Committee. Parkes Museum, Margaret street, W., London; 1895.

THE ENGLISH OF THE PSYCHOPHYSICAL MEASUREMENT METHODS.

By E. B. TITCHENER.

For some years past I have had it in mind to issue for class use a series of four-page leaflets, giving the schemata of the principal measurement methods (just noticeable stimuli, minimal changes, equivalents, mean gradations, average error, right and wrong cases) with concrete illustrations. My aim would be to subordinate mathematics to psychological analysis; to show the introspective reason for each step in each method, but to make the mathematical treatment of the results a matter of rote. The mathematical basis of the error methods might then be set forth in a separate appendix to the six leaflets, should there be any demand for it.

The carrying out of this idea has been delayed by the lack of English symbols for the exposition of the methods. In the translator's preface to Knelp's "Outlines of Psychology" (1895) I wrote: "Many English writers on psychophysical questions have employed the German abbreviations; there are obvious difficulties in the way of an English terminology; and it is not probable that any proposals which could be made at the present time would find general acceptance." I hoped that, if attention were thus called to a serious defect in our working apparatus, some one might come forward with suggestions for a remedy. The hope has not been fulfilled. I therefore venture to offer some suggestions of my own. I do so because I feel that leaflets of the kind just described would be of real service in my own class work, and presumably in that of other psychologists.

Sensitivity and sensible discrimination can evidently be shortened, as they have been in some of the periodical summaries in *Mind*, to *S* and *SD*. Sensation must be represented by *s*. There is then every reason to keep the German *r* as the symbol for stimulus; there can be but few students who have not come across an *r* used in this sense, and *r* comes before *s* in the order of the alphabet as stimulus before

sensation in the order of the experiment. A difference between two stimuli, any $r - r_1$, will be D ; the just noticeable difference or difference limen Δr . The stimulus limen or just noticeable stimulus may then be termed r_{λ} . We thus have r_{λ} as the measure of sensitivity,¹ and Δr and $\frac{\Delta r}{r}$ as the measures of the absolute and relative SD respectively. The standard stimulus I call U (uniform), the stimulus of comparison V (variable); so that $\frac{\Delta r}{r}$ becomes, in practice, $\frac{\Delta r}{U}$. The mean variation is mv , written as the case requires mv , $\frac{mv}{r}$, $\frac{mv}{U}$, or $\frac{mv}{D}$; the mean or average error is me .

Paralleling these symbols with those given by Kuelpe in his Table on pages 52, 53, we have:

German.	English.	Stimulus.
r, r_1, r_2, r_3, \dots	r, r_1, r_2, r_3, \dots	Stimulus difference.
Δr or D or $r - r_1, \dots$	Δr or $r - r_1, \dots$	Difference limen.
S or j. n. Δr ,	Δr ,	Stimulus limen.
German S , or j. n. r, r_{λ} ,		Abs. mag. of SD .
$\frac{\Delta r}{r}, S$,	$\frac{\Delta r}{r}$,	Rel. mag. of SD .
N ,	U ,	Standard stimulus.
V ,	V ,	Stim. of comparison.
M ,	M ,	Arithmetical mean.
MV ,	mv ,	Mean variation.
$\frac{MV}{r}$,	$\frac{mv}{r}$,	Rel. del. of S .
MV , $\frac{MV}{N}$,	mv , $\frac{mv}{U}$,	Rel. del. of SD .
$\frac{\Delta r}{r}$, $\frac{\Delta r}{N}$,	$\frac{\Delta r}{r}$, $\frac{\Delta r}{U}$,	
r or Δr ,	r or Δr ,	Subliminal r or D .
r or Δr ,	r or Δr ,	Supraliminal r or D .
\parallel ,	\parallel ,	Subjective =.
$>$,	$>$,	Subjective >.
$<$,	$<$,	Subjective <.
E ,	S ,	Sensitivity.
UE ,	SD ,	Sensible discrimination.

The method of just noticeable stimuli requires the further signs r_{λ_u} and r_{λ_d} . That of minimal changes requires Δr_u , Δr_d , r_u , r_d and their variants, together with R and Δ . The relation limen² I propose to express by Jr ; so that

¹ I use λ , and not l , to avoid confusion of the l with the numeral 1 in printing and black-board writing.

² I choose λ as the initial letter of the Greek $\lambda\delta\mu\sigma$, ratio.

$$\frac{r_o}{r} = Ar_o, \quad \frac{r}{r_u} = Ar_u, \text{ and } \sqrt{Ar_o \cdot Ar_u} = \sqrt{\frac{r_o}{r_u}} = Ar.$$

The methods of equivalents and of mean gradations introduce no new expressions.

In the method of right and wrong cases we set out from a *D* that is very little $\gtrless \Delta r$, and obtain the equation :

$$\frac{r}{n} + \frac{w}{n} + \frac{e}{n} + \frac{d}{n} = 1;$$

where *r* is right, *w* wrong, *e* equal and *d* doubtful, and *n* denotes the number of observations. The use of *r* in this method has bred no confusion in German statements of it, and need not do so in English.

For the error stimuli in the method of average error I use the symbol r_ε . We have, therefore :

$$\frac{r_{\varepsilon_1} + r_{\varepsilon_2} + r_{\varepsilon_3} + \dots + r_{\varepsilon_n}}{n} = R_\varepsilon.$$

The German Δm then becomes mv_ε , and Δm_1 becomes me_ε .

The English terms suggest what the values really are : the mean variation and average error of the error stimuli obtained.¹

I subjoin Kuelpe's final Table (p. 78) and the corresponding list of English signs. The *h* which appears in both tables is Gauss' measure of precision.

GERMAN.

Stimulus and Difference		Determination		Comparison
<i>E.</i>	Magnitude	German S.		$\frac{r}{E} \parallel r_1$ ($E:E_1 = r_1:r$)
	Delicacy	MV; MF		$MV; MF$
<i>U. E.</i>	Absolute	<i>S</i>	$\frac{\Delta r}{UE}$	$\frac{\Delta r}{UE} \parallel \frac{\Delta r_1}{r_1}$ ($UE:UE_1 = \Delta r_1:\Delta r$)
	Relative	$\frac{S}{r}$	$\frac{\Delta r}{r}, \frac{\Delta r_1}{r_1}; r:r_1 = r_1:r_2$	
Del.	Absolute	<i>MV; MF; h; Δm</i>	$MV; MF$	
	Relative	$\frac{MV}{r}; \frac{MF}{r}; h_x; \frac{\Delta m}{r}$	$\frac{MV}{r}; \frac{MF}{r}; \frac{MV}{\Delta r}; \frac{MF}{\Delta r}$	

¹ For the r_ε sign series I am indebted to Mr. I. M. Bentley, who has kindly revised this paper in MS. The Greek ε is taken to avoid the symbol me_ε .

ENGLISH.

Stimulus and Difference		Determination	Comparison
S.	Magnitude	r_j	$(S : S_1 = r_1 : r)$
	Delicacy	$mv; me$	$me; me$
SD.	Absolute	Δr	$(SD : SD_1 = D_1 : D)$
	Relative	$\frac{\Delta r}{r}$	$\frac{D}{r}, \frac{D_1}{r_1}; r : r_1 = r_1 : r_2$
Del.	Absolute	$mv; me; h; mv_i, me_i$	$mv; me$
	Relative	$\frac{mv}{r}; \frac{me}{r}; h.r; \frac{mv_i}{r}, \frac{me_i}{r}$	$\frac{mv}{r}; \frac{me}{r}; \frac{mv}{D}; \frac{me}{D}$

I shall greatly value any criticism of these proposals, as well as of the plan of issuing method leaflets. I shall also be glad to know whether laboratory psychologists would welcome the publication of blank sheets prepared for the recording of method work in the drill course.¹ The following, e. g., shows such a sheet prepared for the method of just noticeable stimuli :

“ Experimenter, Subject, Instrument,	Unit, Date, Hour,	
Series		
Initial value of r_j^v ,	Size of steps,	Value of r_{j_o} ,
Initial value of r_j^s ,	Size of steps,	Value of r_{j_u} ,
r_j		
Mag. of S for stimuli = .		

Remarks :
References.”

¹ Since the sending of this paper to the printer, I have received Vol. IV of the *Yale Studies*, in which Dr. Scripture describes certain of the experiments given in his drill-course. The note-book made up by the Yale students has some points of resemblance to that which would be made up from my printed blanks; but the two differ very considerably both in method and in object. I therefore leave the above paragraphs as they were written. It may be that the near future will see the publication of a number of laboratory note-books, differing as current text-books differ. The result would be, on the whole, a distinct gain to experimental psychology; the place of the science in the undergraduate course could be better defined, and the undergraduate training of the candidate for graduate scholarships better estimated than is now possible.

Taking Kuelpe's illustration (p. 55), we can fill out the blanks thus:

Experimenter, A. B. C.

Unit, 1 mgr.

Subject, X. Y. Z.

Date, Jan. 27, 1898.

Instrument, Minimal Pressure Weights.

Hour, 3 P. M.

Series r_v to r_u , r_u to r_v .

Initial value of r_v , 1 mgr. Size of steps, 1 mgr. Value of r_{v_0} , 4 mgr.

Initial value of r_u , 9 mgr. Size of steps, 1 mgr. Value of r_{u_0} , 6 mgr.

$r_s = 5$ mgr.

Mag. of S for pressure stimuli = $\frac{1}{2}$.

Remarks:

Weights were applied to tip of forefinger of right hand.

Same result was reached if the first step in each direction was made 2 mgr., and the following steps 1 mgr.

Remember to repeat the whole series, working from r_v to r_u , and then from r_u to r_v , for the elimination of possible constant error.

Advisable to repeat both series several times; results interfered with by slipping of weights, unevenness of contact, tickling.

Notice that the mr , measure of delicacy, coincides with unit of instrument. To get a reliable mr , the unit must be made smaller.

Etc., etc. Effects of habituation, expectation, predisposition, practice, fatigue.)

References:

Kuelpe, "Outlines," p. 56.

Wundt, "Lectures," p. 50.

Etc., etc.

MINOR STUDIES FROM THE PSYCHOLOGICAL
LABORATORY OF CORNELL UNIVERSITY.

COMMUNICATED BY E. B. TITCHENER.

XVI.—A STUDY OF CERTAIN METHODS OF DISTRACTING
THE ATTENTION.

III. DISTRACTION BY MUSICAL SOUNDS; THE EFFECT OF
PITCH UPON ATTENTION.

By L. DARLINGTON, A. B., and E. B. TALEOT, A. B.

The experiments described in this paper were made during the year 1896-'97. Their main object was to determine (1) whether there is any relation between the pitch of a musical note and its effect upon the attention, and (2) whether music, when used for purposes of distraction, has any direct dynamogenic effect, and, if so, what it is. We hoped also to get (3) some general results in regard to the value of the musical phrase as a distraction. A fourth question, quite foreign to our first intention, suggested itself early in the work; and the experiments were arranged so as to bear upon it as well as upon our chief problem. The attention of the subject was tested by his discrimination of lifted weights; and the side-issue which we tried to settle was (4) the question whether upward, downward, or double movements are best for the comparative estimation of lifted weights.

The method employed was that of right and wrong cases. The details of the experiment were as follows: The subject sat sidewise at a low table, with his right fore-arm resting upon it, the ulnar side down. His eyes were closed. Above his arm, and at right angles to it, was a small iron rod, to limit the distance through which the hand should be raised or lowered. The rod was wrapped with woolen cloth in order to prevent distraction from temperature sensations. Its height above the table was 22 cm. The weights used were two wooden boxes, like enlarged port-wine glasses broken off short in the stem and lidded, about 6.5 cm. in diameter at the top, containing fine shot. For two of the subjects (*Se.* and

P.) the weights were 250 g. and 265 g. respectively. For the third subject (*Sh.*) they were 250 g. and 260 g.¹

At the word 'ready,' the subject put his hand in the proper position for the experiment, with the fingers bent in so that the thumb and fore-finger formed a ring. If downward movements were to be made, the hand was raised until the volar side of the wrist touched the rod, the elbow remaining on the table. Two seconds after the signal was given, the first weight was placed in the support formed by the thumb and fore-finger, and the required movement—upward, downward, or double—was made. As soon as the movement was finished, the weight was removed from the hand. Two seconds after the completion of the movement, the second weight was given, without a signal, and the movement was repeated.

The experiments were made in series of twenty-five each, and three different 'patterns' were used.² In the following list, *a* indicates that the lighter weight and *b* that the heavier was given first. Each pattern, whenever used, was repeated with the letters transposed.

First Pattern.	Second Pattern.	Third Pattern.
<i>b</i>	2 <i>a</i>	3 <i>b</i>
2 <i>a</i>	3 <i>b</i>	2 <i>a</i>
3 <i>b</i>	<i>a</i>	2 <i>b</i>
2 <i>a</i>	2 <i>b</i>	3 <i>a</i>
2 <i>b</i>	2 <i>a</i>	<i>b</i>
<i>a</i>	2 <i>b</i>	2 <i>a</i>
2 <i>b</i>	<i>a</i>	2 <i>b</i>
3 <i>a</i>	<i>b</i>	<i>a</i>
<i>b</i>	2 <i>a</i>	3 <i>b</i>
<i>a</i>	2 <i>b</i>	<i>a</i>
<i>b</i>	3 <i>a</i>	2 <i>b</i>
2 <i>a</i>	<i>b</i>	3 <i>a</i>
3 <i>b</i>	2 <i>a</i>	
<i>a</i>	<i>b</i>	
—	—	—
25	25	25

The distraction consisted of twenty-five phrases, of nine notes each, played upon the piano. All were written in $\frac{2}{4}$ time and in the key of C.³ Five different octaves were used,

¹ We had assumed that a difference of 10 g. (i. e., of $\frac{1}{3}$ g.) would be supraliminal; but preliminary experiments showed that for *Se.* and *P.* a larger difference was necessary.

² *Phil. Stud.*, XI, 224.

³ The following is No. 3 of the set of 'phrases,' some of which we adopted from G. Viehl's "Graded Studies in Sight Singing" (1896), while others we put together ourselves :



the notes ranging from the e^{-1} to the e^4 . In each series of twenty-five experiments, five phrases were played in each octave. The order of the phrases was changed with each series, and no exercise was played twice in the same series. The succession of the octaves was so arranged that each occupied any given position (*e. g.*, the first) just as often as every other octave. Moreover, it was very seldom (only once in ten series) that any octave followed the one just above or below it on the piano.¹

Experiments were made with three subjects: Miss S. E. Sharp (*Sh.*), Miss N. G. Seymour (*Se.*) and Dr. W. B. Pillsbury (*P.*). All were trained subjects. *P.* was 'unmusical'; *Sh.* averagely, and *Se.* exceptionally 'musical'. There were four classes of experiments :

- I. Without distraction.
- II. With distraction throughout the experiment.
- III. With distraction in the first half.
- IV. With distraction in the last half.

The four classes are referred to by Roman numerals throughout this paper.

In I, 600 experiments were made by *Se.* (200 for each of the three movements) and 450 by *Sh.* and *P.* In II, III and IV, *P.* performed 500, and *Se.* and *Sh.* 750 in each class. This gave *Se.* and *Sh.* 250 experiments for each of the three movements in each set, while *P.* had either 150 or 175 for each movement of each set.² Or, if we estimate according to octaves, in each class *P.* performed 100 experiments and *Se.* and *Sh.* 150 for each octave. The movement and the class of experiments were varied frequently, so as to insure equal degrees of practice in all.

The following Tables (A to D) give the results of our experiments so far as they have a bearing upon the question of *distraction*. In each of these tables, the double, upward and downward movements are averaged. The figures indicate the percentages of right judgments.³

¹In order to secure this result and the still more important one of equal distribution of the octaves, it was necessary that the number of series taken should be some multiple of ten; *e. g.*, when double movements were used, each subject had to make either 250 experiments, or 500, or 750, and so on.

²This inequality is due to the fact that, as explained above, we could not use more than 500 experiments in any class, unless we had time to make as many as 750.

³These percentages are obtained in the usual way; $r^1 = r + \frac{e}{2}$. *P.* and *Se.* gave exceedingly few *e* judgments from the first. *Sh.* gave more; but the number rapidly decreased with practice. It does not seem necessary, for our present purpose, to print the full tale of *r*, *w* and *e*.

TABLE A.
(Class II.)

SUB-JECT.	Octave I.	Octave II.	Octave III.	Octave IV.	Octave V.	Average.	No Distraction.
Se.	81	75	72	84	80	78	73
P.	75	81	72	80	73	76	74
Sh.	74	78	72	76	69	74	71

TABLE B.
(Class III.)

SUB-JECT.	Octave I.	Octave II.	Octave III.	Octave IV.	Octave V.	Average.	No Distraction.
Se.	79	81	73	73	77	77	73
P.	84	75	74	84	79	79	74
Sh.	63	66	74	72	64	68	71

TABLE C.
(Class IV.)

SUB-JECT.	Octave I.	Octave II.	Octave III.	Octave IV.	Octave V.	Average.	No Distraction.
Se.	85	85	81	79	79	82	73
P.	73	77	71	83	82	77	74
Sh.	76	67	76	74	69	72	71

TABLE D.
(Average of II, III and IV.)

SUB-JECT.	Octave I.	Octave II.	Octave III.	Octave IV.	Octave V.	Average.	No Distraction.
Se.	82	80	75	79	79	79	73
P.	77	78	72	82	78	77	74
Sh.	71	70	74	74	67	71	71

In the light of these results we may consider the questions (1) whether music furnishes an adequate *distraction* and (2) whether the effect produced by it has any constant relation to *pitch*. Of our four Tables, A furnishes the safest basis for an answer to the first question. For it might well be that in II the music would have a different effect from that which it exercised in III and IV. If we give the music only in one-half of the experiment, we may be simply 'distracting' through that half, and not affecting the other half at all; or we may be altering the whole experiment. In the latter case two opposite results are possible. The music may facilitate the attention, by sharpening the contrast between the two parts of the experiment; or it may confuse the subject, and thus inhibit the attention. And in a case where the music facilitates in II, it may very well have the opposite effect in III and IV. Hence if the different Tables suggest different conclusions, we should give more weight to the testimony of A than to that of B and C, or even of D.

With *Se.* and *P.*, however, the conclusions drawn from all four Tables are the same; viz., that *in general the music facilitates* rather than inhibits the attention; though for *Se.* one case (octave) in fifteen, and for *P.* four in fifteen, show the opposite result. With *Sh.*, on the contrary, Table C shows a deviation from this rule which is sufficient to affect the average results (in D). If, however, we base our judgment upon the results of Table A, we see that for *Sh.* also, the general effect of the music is that of facilitation, though in one octave it slightly inhibits. We conclude, then, that for these three subjects music throughout the experiment facilitates the attention, and that music in one-half has the same effect five times in six; i. e., in all the sets except *Sh.*'s III. Whether, in general, music in one-half helps *more* than music throughout the experiment, the figures do not show conclusively. With *P.*, the facilitation is greater in III and IV than in II; with *Se.*, it is greater in IV and less in III; while with *Sh.*, it is less in IV and gives place to inhibition in III.

We turn now to the second question. M. Fétré concluded from the results of his experiments that the dynamogenic effect of a musical note is greatest in the middle octaves.¹ If

¹Ch. Fétré, "Sensation et Mouvement," Paris, 1897, esp. p. 35. Fétré worked with single clangs, not with phrases; and warns his readers against confusing the direct dynamogenic effect of the note with the associative influence of the 'morceau' (p. 38). Our phrases, however, did not suggest a musical air, i. e., were not associative. Hence the results of the two investigations are largely comparable. Again, Fétré's curve (p. 35) appears to have been taken from a 'hypnotique.' But he distinctly says that the results obtained with

we grant this hypothesis for a moment, the question is at once suggested whether the effect upon attention follows the same law or the opposite one; *i. e.*, whether the middle octaves have the greater effect upon attention—either in the way of facilitation or of inhibition—or whether they have the smaller effect. There does not seem to be any reason for supposing *a priori* that the psychological effect should follow the same law as the physiological. And when we examine the Tables we cannot find conclusive testimony in favor of either alternative. *If there is any fixed relation*, however, it seems probable from these results that *the middle octaves have the greater effect upon attention*. If we leave *Sh.*'s results out of account for the present, we notice in those of *Se.* and *P.* (1) that in all but one of the eight cases (four for each subject) the middle octave shows the lowest percentages; and (2) that in four of the seven cases in which it is lowest its percentage falls below that of no-distraction, in two it is equal to that of no-distraction, and is higher in but one. Since there is so great a tendency for the percentages of the middle octave to fall below that of no-distraction, while yet the average results for the five octaves are in every case better than that for no-distraction, we cannot adopt the theory that the middle octave has the least effect upon consciousness. We must rather suppose that it has an effect so great that the point of maximal facilitation has been already passed and inhibition has set in. In some cases, the inhibition produces a sudden falling of the attention-curve below the line of no-distraction; *e. g.*, in *P.*'s results in A and D, we find the highest points represented in Octaves 2 and 4, while in Octave 3 the curve falls below the no-distraction line. This seems to show that the point of highest facilitation is immediately succeeded, not by a smaller degree of facilitation, but by actual inhibition. On the other hand, in *Se.*'s C and D, we have, after the maximal point in Octave 2, a lessening of facilitation which does not amount to inhibition. Of these eight cases, five (*i. e.*, all but *P.*'s A and C and *Se.*'s C) seem, when taken separately, to support the theory that the middle octaves have the greater effect upon consciousness: *e. g.*, in *P.*'s D, Octave 1 shows facilitation; Octave 2, slightly greater facilitation; Octave 3, inhibition; Octave 4, facilitation; and Octave 5, diminished facilitation. When we compare the five cases with one another, however, we find some discrepancies; *e. g.*, in *Se.*'s A

neuropathic and hysterical subjects differ only in degree from those gained with normal subjects (pp. 32, 33). Dr. Scripture's curve ("Thinking, Feeling, Doing," p. 86) is evidently a copy of Féré's, generalized and translated from *kg.* into *lbs.* Cf. the figures on pp. 87, 88 with Féré, pp. 37, 38, 43, 49.

and D the points of maximal facilitation seem to be in Octaves 1 and 4, while in her B they are in Octaves 2 and 5. We notice, also, two cases, viz., P.'s A and C, where one end of the attention-curve falls below the line of no-distraction. When we turn to Sh.'s results, we find even greater difficulties for the theory. Her figures in A exemplify it fairly well; but those of C and D are difficult to explain, while those of B directly contradict the theory. According to the results of B, the middle octaves affect consciousness least; for we have facilitation in Octaves 3 and 4, and inhibition in Octaves 1, 2 and 5. In the face of so much contradiction we must give up the attempt to deduce from our results any clear-cut relation between pitch and the effect upon the attention, although the indications are undoubtedly as stated above.

Table E shows the bearing of our results upon the question of *dynamogenesis*. As explained above, *a* indicates that the lighter and *b* that the heavier weight was given first. The first two rows of figures in each set (*e. g.*, III *a* and III *b*) give the percentages of right judgments for *a* and *b* respectively. In the rows marked *Diff.*, we have the amount by which the *a*-judgments are better than the *b*-judgments. In the rows marked *Per cent.*, we have the percentage obtained by dividing this difference by the percentage of the *a*-judgments.

If the music has a dynamogenic effect, the fact should appear from an examination of the Table. Since there is a general tendency toward over-estimation of the second weight (time error), we should expect to find in I and II, as we do, a higher percentage of right judgments in *a* than in *b*. Now if the music, by bracing the muscles, makes the weights appear lighter, then in III, where the music is played only during the first half of the experiment, the difference between the *a* and the *b* judgments should be greater than in I and II. In IV, on the contrary, the music, which is played only in the second half, should counteract, either wholly or in part, the tendency to over-estimate the second weight. Consequently, the superiority of *a*-judgments over *b*-judgments should be either lessened or entirely destroyed—or, possibly, even changed to a superiority of *b* over *a*. Moreover, if M. Fétré is right in maintaining that the dynamogenic effect is greater in the middle octaves, these results should be more apparent in Octave 3 than in Octaves 1 and 5.

Let us consider first whether there is any general dynamogenic effect. On the whole, it looks as if there were. For *P.*, the difference between *a* and *b* is, on the average, somewhat greater in III than in either I or II, though in some octaves this is not the case; while in IV it is, on

TABLE E.

SUBJECT.		Octave I.	Octave II.	Octave III.	Octave IV.	Octave V.	Aver- age.	No-Dis- tract'n
Se.	II <i>a</i>	84	79	77	87	84	82	83
	II <i>b</i>	77	73	68	79	77	75	62
	Diff.	7	6	9	8	7	7	21
	Per cent.	8.3	7.6	11.7	9.3	8.3	8.5	25.3
	III <i>a</i>	86	84	77	80	84	82	83
	III <i>b</i>	73	78	69	65	70	71	62
	Diff.	13	6	8	15	14	11	21
	Per cent.	15.1	7.1	10.4	18.8	16.7	13.4	25.3
	IV <i>a</i>	93	90	82	83	85	87	83
	IV <i>b</i>	78	81	79	75	73	77	62
	Diff.	15	9	3	8	12	10	21
	Per cent.	16.1	10	3.7	9.6	14.1	11.4	25.3
P.	II <i>a</i>	90	86	73	83	76	82	81
	II <i>b</i>	60	77	71	75	68	70	68
	Diff.	30	9	2	8	8	12	13
	Per cent.	33.3	10.5	2.7	9.6	10.5	14.6	16
	III <i>a</i>	93	81	86	90	85	87	81
	III <i>b</i>	75	68	63	77	73	71	68
	Diff.	18	13	23	13	12	16	13
	Per cent.	19.4	16	26.7	14.4	14.1	18.4	16
	IV <i>a</i>	72	77	76	88	85	80	81
	IV <i>b</i>	74	77	66	77	79	75	68
	Diff.	2	0	10	11	6	5	13
	Per cent.	2.8	0	13.2	12.5	7.1	6.3	16
Sh.	II <i>a</i>	79	83	75	85	79	80	81
	II <i>b</i>	69	73	68	67	59	67	61
	Diff.	10	10	7	18	20	13	20
	Per cent.	12.7	12	9.3	21.2	25.3	16.3	24.7
	III <i>a</i>	76	79	87	81	78	80	81
	III <i>b</i>	50	54	63	62	50	56	61
	Diff.	26	25	24	19	28	24	20
	Per cent.	34.2	31.6	27.6	23.5	35.9	30	24.7
	IV <i>a</i>	75	69	78	80	67	74	81
	IV <i>b</i>	77	64	75	69	71	71	61
	Diff.	-2	5	3	11	-4	3	20
	Per cent.	-2.7	7.2	3.8	13.8	-6	4.1	24.7

the whole, much less than in I and II. With *Sh.* this result is even more marked. For every octave, we find the differ-

ence greater in III and less in IV than it is in I and II. In two octaves of IV, we even see the relation of *a* and *b* reversed: the *b*-judgments are somewhat better than the *a*-judgments. *Se.*'s results are less easy to explain. In III the difference is greater than in II, but less than in I; similarly, in IV it is less than in I, but somewhat greater than in II. We notice a fact, however, which may help to explain this discrepancy. For *Se.*, the difference between *a* and *b* is much less in II than it is in I. It is possible, then, that the general effect of the music may be to decrease the difference between *a* and *b* judgments. The reason for this is, perhaps, that the music, by acting as a facilitation, helps to keep the first weight in memory until the second is given. The first weight 'loses' less, in the interval between the two parts of the experiment, and thus the tendency toward over-estimation of the second weight is partly counterbalanced. If we grant this hypothesis, it may help us to reconcile *Se.*'s results with the theory that *P.*'s and *Sh.*'s suggest. In III, the working of the law of dynamogenesis would tend to make the difference between *a* and *b* greater than it is in I; but the facilitation in the first part of the experiment helps to counteract this effect; hence the difference is less than it is in I, though still somewhat greater than in II. In IV, since the music is played only in the second half of the experiment, it does not have this effect. Here we have nothing but dynamogenesis to counteract the tendency toward over-estimation of the second weight; and if we assume that the second factor is more important, we can understand why the difference between *a* and *b* in IV is so much larger than we had expected.

Table F may serve to bring this point out more clearly. The figures are taken from the last two columns of the rows marked Per cent. in Table E.

TABLE F.

CLASS.	Favoring <i>a</i> .	Favoring <i>b</i> .	Per cent. of Difference in Favor of <i>a</i> .		
			<i>Se.</i>	<i>P.</i>	<i>Sh.</i>
I	Time-error		25.3	16	24.7
II	Time-error	Facilitation	8.5	14.6	16.3
III	{ Time-error Dynamogenesis }	Facilitation	13.4	18.4	30
IV	Time-error	Dynamogenesis	11.4	6.3	4.1

If one can draw any conclusion from these results, it is that in *Se.*'s case facilitation is a more important element than dynamogenesis in determining the relative accuracy of *a* and *b* judgments in III and IV; while for *Sh.* and *P.* dynamogenesis is the more prominent factor. We have no desire to assert that these results *prove* anything; but they seem to hint at the presence of a dynamogenic law, and also to indicate that a 'distraction' which acts as a facilitation will, if given with the first of two stimuli, partly counteract the tendency to underestimate it. That this counteraction is especially marked in *Se.*'s case may be due to the fact that she has had a very exceptional musical training.

We may now turn to the question whether or not the dynamogenic effect is shown most strongly in the middle octaves. If it is, the difference between *a* and *b* will be greater in III and less in IV for the middle octaves than for the others. For *Se.*, this relation is not found in III; while the fourth octave has the greatest difference, the second and third have the least. In IV, on the other hand, *Se.*'s percentage for the third octave seems to support Fétré's theory; but the value of its testimony is lessened when we remember that, in order to explain *Se.*'s average results in IV, we had to assume that dynamogenesis has comparatively little effect with her. If

TABLE G.

SUBJECT.	MOVEMENT.	CLASS.				AVERAGE.
		I.	II.	III.	IV.	
<i>Se.</i>	Double	78	84	82	83	82
	Up	74	77	77	82	78
	Down	67	74	71	81	73
<i>P.</i>	Double	77	77	84	81	80
	Up	70	78	75	77	75
	Down	75	73	78	77	75
<i>Sh.</i>	Double	75	72	68	73	72
	Up	68	77	68	71	71
	Down	70	72	68	72	71

this is the case, it is difficult to understand the suddenness of the descent from Octaves 2 and 4 to Octave 3.¹ With *P.*, the difference in III is greatest for the third octave, as it should be; but unfortunately it is also greatest for this octave in IV. Moreover, the second octave in III presents a difficulty. With *Sh.*, in III, the third and fourth octaves show the least differences instead of the greatest; while in IV, the percentage of the third octave, though less than that of Octaves 2 and 4, is greater than that of Octaves 1 and 5. On the whole, then, *it does not seem that we can assert any essential relation between pitch and dynamogenic effect.*

Our last table, G, is designed to show which is the best movement for estimating lifted weights. The figures indicate percentages of right judgments. In getting the figures in the column marked *Average*, due account was taken of the fact that fewer experiments were made in I than in II, III or IV.

From these results it appears that *double movements* are uniformly best for *Se.*, are best for *P.* in three cases in four, and are, on the whole, slightly best for *sh.* For *Se.* upward movements are better than downward, while for *P.* and *Sh.* the two movements are about equally good. If we look at promptitude and subjective certainty of judgment, we must put the double movement a little ahead of the upward, the upward very considerably ahead of the downward. Hence the curves of magnitude and delicacy of *SD* show the same general trend, but do not run strictly parallel (*cf.* Külpe, "Outlines," p. 50).

There were certain defects in our method of experimentation which, with more foresight, might have been avoided; and it may be well to mention them here. (1) Each series consisted of twenty-five experiments, or five in each octave. This gave in any particular octave a predominance of either *a's* or *b's*; and since several different 'patterns' were used, we found, when we came to average our results, that some octaves had more *a's* than *b's*, and others more *b's* than *a's*. Since *a*-judgments tend to be better than *b*-judgments, this introduced an error into the figures of Tables A-D. The amount of the error was computed, and it was found that in seven of the seventy-two cases in those Tables a correction of 1% was required. The correction is included in the figures as given. In no case does it alter the relations of any two octaves. The error might have been avoided if we had used

¹ It is interesting to notice that *Se.*'s IV is the sole case of the six that furnishes a good illustration for Fétré's theory. Taken by itself, it is excellent evidence for the theory: it is only when we compare it with the other results of the same subject that it fails.

series of thirty experiments, and had arranged the patterns so that in each series the number of *a's* and *b's* in any octave would be equal. Our reason for not using a series of fifty experiments was that we found upon trial that the subject became fatigued before the series was finished. (2) The attempt to solve the problem of double, upward and downward movements in connection with our main question was probably unwise, since, as we have seen, it greatly limited the number of experiments that could be used. We were led to it by the consideration of its possible theoretical importance (*cf.* Miss Parrish's experiments, this JOURNAL, VIII, pp. 51, 52). (3) The order in which the phrases were played was varied, so that the subject might not expect any particular phrase at any time. No attempt was made, however, to arrange the succession in such a way that each phrase would occur in one octave as many times as in another. This would have been somewhat difficult, since the order of octaves was also changed with every series. Still, if we were to repeat the investigation, we should try to remove this possible source of error.

We may sum up the results of our investigation in the following points :

(1) In general, the effect of the music was to *facilitate attention*, both when it was played throughout the experiment and when it was played in one-half only. In other words, under the conditions in which we used it, the music did *not serve as a true distraction*.

(2) There is some evidence, though it is not conclusive, of a dynamogenic law operative in III and IV.

(3) There is no evidence of any constant relation between pitch and dynamogenic effect, and hardly any of such a relation between pitch and 'distracting' power.

(4) It seems probable that a slight distraction, given with the first of two stimuli that are to be compared, will counteract to some extent the tendency toward over-estimation of the second stimulus (time error).

(5) For the comparative estimation of lifted weights, double movements appear to be somewhat better than single (either upward or downward) movements.

POSTSCRIPT.

The three Studies, XII, XIV and XVI, were undertaken with the view of discovering a means of distraction that should be capable of gradation, uniform in its working and

applicable to normal subjects. With such a distraction it would be possible, on the qualitative side, to describe the attributes of mental processes given in the state of inattention, and, on the quantitative, to measure the magnitude and delicacy of sensitivity and sensible discrimination in the same state.

Unfortunately, the work done upon the question had to be divided up into three parts, each to be completed within a year. Although we foresaw that such work would necessarily prove incomplete and, so far, unsatisfactory, we still judged the attempt at a solution of the problem to be worth the making. Now that it is finished we have, at least, and apart from any positive results, done something toward clearing the ground for future investigators. As for the results themselves, they may be summarized as follows:

(1) The use of a stimulus as a distraction does not by any means guarantee distraction. The 'distracting' stimulus may, in reality, reinforce or facilitate the attention.

(2) Many stimulus complexes are inherently unsuited to act as distractors. Among them are addition and similar arithmetical exercises, spelling, translating, etc., and musical phrases.¹

(3) It must not be assumed that the effect of a distraction is limited to that part of the experiment which it accompanies. The attention may be given to or abstracted from the experiment as a whole; and distraction during a part of the experiment may affect the attention to the whole. This fact very greatly complicates the distraction problem.

(4) The most promising distractors are those that appeal most directly to affection, the obverse of attention; the least promising are those that appeal solely to the 'intellect,' and themselves demand active attention.² Odors have proved capable of furnishing a satisfactory distraction series.

(5) When one goes behind the numerical results and enquires into the mental mechanism of distraction, one is at once introduced into the field of individual psychology. It is, therefore, probable that the requirement which we set ourselves to fulfill is, in its strict formulation, impossible of ful-

¹Some of these may, perhaps, be utilized in the future under the conditions laid down by Miss Hamlin: this JOURNAL, VIII, p. 62.

²So, too, Miss Hamlin: "When the addition was performed while there was any strong affective coloring of the subject's consciousness, it was usually a successful means of distraction." JOURNAL, VIII, p. 62; and Dr. Daniels: "The reading of interesting stories in a loud voice and with the greatest possible rapidity" proved a useful mode of distracting. Note that the loudness and the interest are both appeals to the passive attention, and that the rapidity secures some sort of continuity. JOURNAL, VI, p. 559.

filment. ‘Uniformity of working’ is, it would seem, not to be secured.¹

In conclusion, we would remind the reader that these results are valid only under the conditions of our experiments. There are many fields, both of sense discrimination and of distraction, which we have not touched at all. It is quite possible that some of the presuppositions of our work are wrong; psychologists are not by any means at one in regard to the significance of the results obtained by the method of right and wrong cases, the meaning of the time error, etc. It is greatly to be hoped that in the near future the whole issue may be raised more thoroughly than we have been able to raise it.

E. B. T.

¹Hence I should avoid any such distractors as stories, musical airs, etc. They will distract, if they arouse associated ideas, and so possess an affective value; but the confusion of individual psychology becomes thereby worse confounded.

THE REPRESENTATION OF TINTS AND SHADES OF COLORS BY MEANS OF ROTATING DISCS.

By A. KIRSCHMANN.

In a former article of this JOURNAL I gave, on the basis of a mathematical deduction, directions for the construction of discs which show, when in rotation, all saturation degrees of a color-tone with exclusion of differences in intensity (A.M. JOURN. OF PSY., Vol. VII, p. 386 ff.).¹ It may sometimes

¹I am sorry to state that by some mistake of the printers, the formulæ which I gave in that paper were distorted almost beyond recognition. I obtained afterwards a number of copies of the article, in which the necessary corrections had been made, but I was not able to provide every reader of the JOURNAL with a copy. Only those who got the corrected offprint can make anything out of the analytic representation of the constructions. For the sake of those who have only the number of the JOURNAL in hand, I may append here the corrected formulæ, page 398 ff.:

The conditions to be satisfied are that the saturation begins at a certain distance d from the centre to decrease in such a way that the length of the radius r and the arc of the corresponding angular value of the color-component, ϕ , are inversely proportional; or:

$$\begin{aligned} \text{When } r = d, \phi &= 180^\circ; \\ “ \quad r = a + d, \phi &= 180 - r; \\ “ \quad r = na + d, \phi &= 180 - ne; \end{aligned}$$

from which follows the equation of the curve

$$\phi = 180 - (r - d) \frac{r}{a};$$

and if we put $\frac{r}{a} = \mu$,

$$\phi = 180 - (r - d) \mu. \quad (1)$$

The value of μ is dependent on the size of the disc. If we wish to have the saturation 0 at the distance R from the centre, we must satisfy the special condition that

$$\phi = 0, \text{ when } r = R.$$

The above stated equation (1) takes, then, the form

$$\mu (R - d) = 180,$$

$$\text{or } \mu = \frac{180}{R - d}.$$

be desirable to produce all *tints* and *shades* of a color-tone, *i. e.*, all the transitions from white to the fully saturated color and from this to black, on one surface. In case we desire a continuous change in a simple arithmetical progression, this can be accomplished by a disc of the nature of that in Fig. 1, the simple construction of which scarcely requires any explanation. The inner part (I in our figure) is the very same as part A in Fig. 2 of the earlier article, and the outer part (III in our figure) is bounded by the continuation of the same common spirals, whose equation with reference to polar-coordinates could be derived as follows:

Let us call d the distance from the centre from which we wish to start, and R the radius of the disc, whilst the variables whose interdependence we are to express by the equation, *i. e.*, the radius at any place of the disc and the angular distance of the curve from the first radius may be denoted by r

If we substitute this value for μ in the equation of the curve, we have

$$\phi = 180 - \frac{r-d}{R-d} 180,$$

$$\text{or } \phi = 180 \left(1 - \frac{r-d}{R-d}\right) \quad (2)$$

We have to determine now the equation for the curve which divides the remainder of the disc into a white and a black part. Suppose the intensity of the color was equal to that of a gray composed of n° white and m° black. The ratio of the white sector to the whole surface left by the color, then, will be $\frac{n}{n+m}$. And since the angular value of the whole uncolored surface must at any distance from the centre be $180^\circ - \phi$, the angular value of the white always will be

$$(180^\circ - \phi) \frac{n}{n+m};$$

or if we substitute the above stated value for ϕ ,

$$\frac{180(r-d)}{R-d} \cdot \frac{n+m}{n}. \quad (3)$$

In order to eliminate possible errors introduced by the spatial arrangement, it will be advisable to carry out each series of experiment with two discs, the one with the above stated arrangement, the other with the saturation increasing from the centre to the periphery. In this case the equations, corresponding to the above stated (2) and (3), read as follows:

$$\phi = \frac{180(r-d)}{R-r},$$

and the angular value of the white sector, the width of which is now decreasing from the centre to the periphery, can be expressed thus:

$$180 \left(1 - \frac{r-d}{R-d}\right) \cdot \frac{n}{m+n}.$$

and φ respectively. The conditions to be satisfied by the equation, then, are :

$$\text{When } r = d, \varphi = o;$$

$$\text{“ } r = z + d, \varphi = y;$$

$$\text{“ } r = nz + d, \varphi = ny; \quad (1)$$

$$\text{and in addition, “ } r = R, \varphi = 360^\circ.$$

From the third of these conditions it follows that

$$n = \frac{r - d}{z}.$$

If we substitute this value for n in the second part of the above statement (1), we have

$$\varphi = \frac{r - d}{z} y.$$

(Page 401 ff.)

If we wish to have an increase of the intensity in a geometrical progression from the centre to the circumference, the following conditions have to be satisfied:

$$\text{When } r = a, \phi = \varepsilon;$$

$$\text{when } r = na, \phi = \varepsilon^n;$$

$$\text{from which follows that } \phi = \varepsilon^{\frac{r}{a}}, \quad (1)$$

$$\text{or } r = a \frac{\log \phi}{\log \varepsilon}. \quad (2)$$

In order to take into account the desired size of the disc, *i. e.*, in order to give φ a determined value X at a certain distance from the centre, we have to satisfy the condition that

$$r = R, \text{ when } \phi = X,$$

where R is the desired radius of the disc.

$$\text{We have, then, } X = \varepsilon^{\frac{R}{a}},$$

$$\text{or } \log X = \frac{R \log \varepsilon}{a},$$

$$\text{from which follows } \frac{a}{\log \varepsilon} = \frac{R}{\log X}.$$

If we substitute this value for $\frac{a}{\log \varepsilon}$ in the equations (1) and (2), we obtain

$$r = \frac{R \log \phi}{\log X},$$

$$\text{and } \phi = \frac{R}{X}. \quad (3)$$

If, on the other hand, a decrease of intensity from the centre is desired, a deduction similar to that above stated leads from the



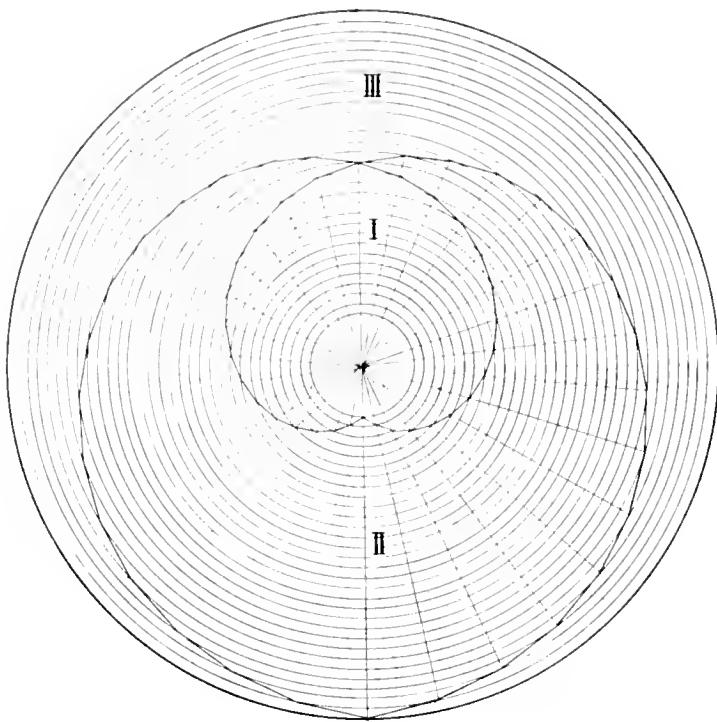


FIG. 1.

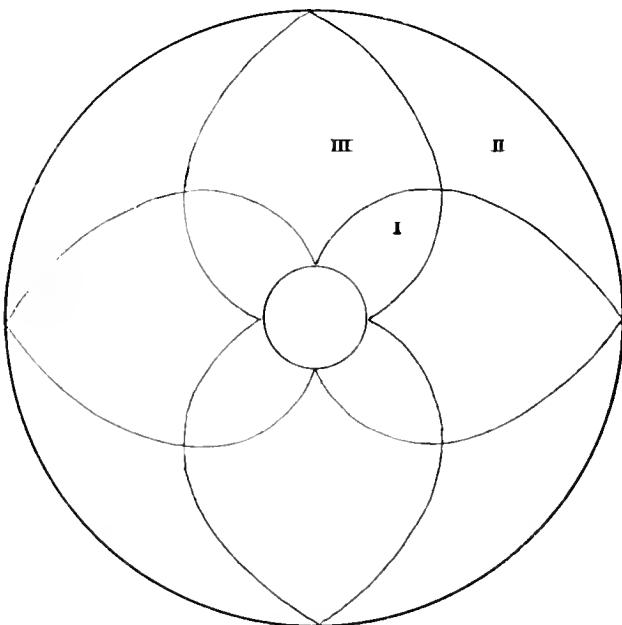


FIG. 2.

Let $\frac{y}{x}$ be called μ , then we have

$$\varphi = (r - d) \mu. \quad (2)$$

In order to eliminate μ , which must be expressed in terms of d and R , we apply the formula just stated to the fourth of the conditions above. It reads, then,

$$360^\circ = (R - d) \mu;$$

$$\text{or } \mu = \frac{360^\circ}{R - d}.$$

Substituting this value in our equation for the curve (2), we obtain

$$\varphi = \frac{(r - d) 360^\circ}{R - d}. \quad (3)$$

In practically applying the above results we have to cover part I of the disc with white, part II with black (black velvet), whilst part III has to be occupied by the color whose tints and shades we wish to produce. A disc of this construction will, when in rotation, show from the centre to the middle of the radius all tints from white to the full saturation of the pigment applied, and from these to the periphery all shades from full saturation to black in continuous transition. Similarly, a disc with black at part I and white at part II will show the very same in opposite order.

In order to facilitate the blending of the components, it may be recommended that the construction should be applied, not for the whole disc, but, perhaps, for each third or quarter of it. Fig. 2 gives the appearance of a disc, which has the above construction for each quadrant.

condition : when $r = na$, $\phi = \frac{n}{1/\varepsilon - 1}$ to the equation

$$\phi = \frac{r}{1/\sqrt[X^k]{-}} \quad (4)$$

where R denotes, as above, the radius of the disc and X the desired angular value of the white at the circumference.

(Page 403 ff.)

$$\text{When } r = na, k\phi + (180 - \phi) = \varepsilon^n,$$

$$\text{or } \phi(k - 1) + 180 = \varepsilon^n,$$

which, treated as in the simpler case above, leads to the equation

$$\frac{R}{\phi(k - 1) + 180} = \sqrt[k]{[X(k - 1) + 180]^r},$$

$$\text{or } \phi = \frac{\sqrt[k]{[X(k - 1) + 180]^r} - 180}{k - 1}.$$

It will easily be seen that, if a logarithmic increase and decrease is desired, the formulæ according to which the disc in Fig. 7 of the former publication is constructed, *i. e.*,

$$\varphi = \frac{r}{V^{\frac{1}{\alpha}}} \quad \text{and} \quad \varphi = \frac{R}{V^{\frac{1}{\beta}}}$$

require only little modification to adapt them to the present purpose.

It may be mentioned, also, that the above described construction may be utilized for demonstrating the totality of possible mixtures between a certain color-tone and a pair of complementary colors; *e. g.*, if we wish to have the transition from yellow to its complementary, violet, not through grey, but through red, we have to cover part III of the above disc with red, and parts I and II with yellow and violet (*or vice versa*) respectively.

SOME ASPECTS OF THE EARLY SENSE OF SELF.

G. STANLEY HALL.

In January, 1895, I printed and circulated a questionnaire (Series 1, No. VII), requesting returns on children's sense of self, to which I have now received 523 replies, upon which this report is based. Nearly all are made by teachers, and about four-fifths are collected by instructors of psychology from their pupils. Some observed a year, some two, and a very few three years, before sending in their papers, some of which were almost treatises, of great interest and instructiveness to me, and many had little or no value. In addition to these data, Mr. Street of this university has kindly permitted me to utilize 387 returns he has collected upon early ideas of the soul. Besides these sources, there have been data from probably several score of miscellaneous, incidental and uncounted papers, so that nearly a thousand persons are here represented.

I. The earliest parts of the physical self to attract attention are the hands and fingers. Sixty-four babies, mostly between two and six months of age, are reported to have examined their hands curiously, and a few showed fear when they were first noticed. Sometimes a hand would be stared at steadily, perhaps with growing intensity, until interest reached such a pitch that a grasping movement followed, as if the infant tried by an automatic action of the motor hand to grasp the visual hand, and it was switched out of the centre of vision and lost as if it had magically vanished. It is the hand in motion, however, that seems first to attract the eye. Some describe an expression of surprise as the hands are moving with an unusual vigor which suddenly arrests attention for an instant, as if the eye first asked, "What are these moving white objects that are so hard to catch or follow?" The mouth has known the hand long before the eye, which first regards it as it would a new toy. It seems probable from the data that the hands know each other, in a sense which Schopenhauer thought so important a stage in self-consciousness, before the eye knows them. Children of four and five months are described as attentively feeling of one hand with the other, each at the same time feeling and being felt, each subject and object to the other, and thus detaching them from the world

of external things and labeling them with a mark which will enable the soul later to incorporate them into the plexus which forms the somatic ego. The hands are stroked, grasped by each other, watched as if they belonged to another, held up and gazed at, studied and compared; one is placed in, beside, upon the other, moved and followed by the eye, held still and moved as if to get the optical effect, and hands of other children, and in one or two cases even other objects, are mistaken for their own. Some curious accounts are given of the hands having gotten under or behind the body, up the sleeve or under the clothes, and thus being lost, while the infant seems to search for them as if with growing apprehension. Sometimes this stage is prolonged. A girl of nine months loved to sit at table, apparently chiefly to play with her hands, and another habitually preferred to use her bottle to study her hands upon rather than to drink from it.

Before and after about twelve months of age, the fingers attract great attention. They are interlaced, rolled, each touched, as if in counting (and it is not irrelevant here to reflect on the enormous amount of tallying and counting that prevailed for unknown ages before mathematical symbols and simple rules have so eliminated it that it is rarely seen save in the strange reerudescence of arithmomaniac), and far more rarely and later each placed against the corresponding one of the other hand. They are pulled, bitten, bent, twisted, and, of course, often persistently sucked, sometimes up to and even into school age. A boy of one year old is said to often pick up his fingers one by one, another of fifteen months to feel of each successively. A girl of two years struck her hand for pulling down a vase; and another, of the same age, pinched her own fingers because they had pinched the baby. A girl of thirty months angrily beat her fingers for tearing a tidy, but said, as is very common, that she did not do it, but her fingers did. Little girls often scold their fingers. These kinds of apostrophe are probably often an imitation of the way parents whip hands that do wrong, but it is interesting that it persists and so many say *e. g.*, "Naughty hands, you always make me bad," or, "You took the cake," "picked the plums," "broke the glass," etc. A girl of three was overheard talking to her hands, which were restless and twitchy. "Why can't you keep still, as mamma (meaning herself) wants you to?" Two girls of three bit their fingers, one till it bled, "to see if it was really me." Besides older finger plays, like piggy, children often invent plays, as of hands and feet going to visit each other, particularly if two children are in bed. Children of three, and even five, sometimes count and recount their own fingers to see if they are all there, and those of

other people to see if they have the same number they have, or the same number on both hands.

Gynecologists tell us that the hand may "find" the mouth before birth. When this occurs it would seem more likely to have significance for the nascentcy of external physical self-consciousness than when hands or feet touch each other or other parts of the body, because the mouth, which is a psychic focus to which everything goes to be tested in early infancy, is more sensitive. Hence to one devoted to a Fichtean dogmatism it might be said that when hand and mouth meet, body consciousness begins. If Berkeley is right concerning the incommensurability of visibilia and tangibilia, the infant gazing at and feeling its hands is, even at this tender age, committing the unpardonable psychological sin from which weary terms of epistemology in junior and senior year, under the best masters, can never wholly cleanse the soul. Even if full purgation of soul on this point be achieved, and then the adept should chance in some moment of reverie to bite his visual finger, he would, at least for a painful instant, backslide to feel that it was a part of the "real me" of touch. Each hand is a subject-object to the other as their mutual acquaintance progresses, and as right-handedness develops, perhaps the left hand is more subjective and the right more objective. At any rate, the right is more prone to trespass across the bilateral plane into the left's domain, and will be always honored and preferred, and the left neglected, so that this equilibrium between subjective and objective that seems so promising is soon hopelessly upset. The eye, however, intervenes just in time, and when the hands could no longer be thesis and antithesis to each other, sublates them to a new synthesis in the higher visual consciousness, which is the truth of the old month knowledge of them. Whereas they were projects, they are now ejects of whatever mind the infant has, and he faintly but pathetically anticipates the adult insight of their nouminal unreality as mere objective phenomena when he "finds them lost." We have thus already the mouth-hands, the hand-hands and the eye-hands, at least, to say nothing whatever of other tactile body hands as the corner-stones of the ego. Each doubtless involves its own centres, although we do not yet know the precise number, tract or cortical location of afferent and efferent fibres, and will not now pause to draw even a schematic diagram of their actions, or describe the slowly growing association fibres which knit them later into will-idea hand centres, because the brain is so complex that any schemata that any of our readers may habitually use will probably be as correct as their favorite number forms, phonisms or photisms. We desire, however, to invite investigation by

those more competent than we to what seem the more important philosophical points involved, viz.: In the first contact of hand and mouth does the latter feel the former first and most, or *vice versa*; does the eye first find the hand because the eye moves, or because the head moves, and does a motor or a sensory process lead? What social and ethical factors are involved in the child's scolding and punishing naughty hands? What symbolic interpretation of the child's many as yet unscheduled finger-plays would be most consonant with the philosophy of Fröbel? And finally, will the purely abstract and deductive metaphysical psychologist tell us whether, so far, we have instinct, feeling, will, reason, attention, or mere automatism? for all that follows is, of course, utterly worthless until described at least in terms of adult consciousness, if not in those of standard metaphysical system.

A special period of "noticing" the feet comes somewhat later than that in which the hands are discovered to consciousness. Our records afford nearly twice as many cases for feet as for hands. The former are more remote from the primary psychic focus or position,¹ and are also more often covered, so that the sight of them is a more marked and exceptional event. Some children become greatly excited when ever their feet are exposed, and especially whenever the foot gear is removed. Some infants show signs of fear at the movement of their own knees or feet covered, and still more often fright is the first sensation which signalizes the child's discovery of its feet. As with the hands, it is often their motion which first attracts attention, and they sometimes, by sudden involuntary movement, leave the field of view and become lost. Being farther away, their vertical and lateral movements subtend to a smaller angle, but they vanish easier at the bottom of the field of view because hidden by the body, clothes, etc. Infants of five to eight months who have found their feet are often described as seeking them with more or less aimless efforts, which are, however, purposive enough to reveal their intent. Later the child acquires the power to seize its feet with its hands, then to lift or kick off the clothes, and still later to remove its stockings to get at the new playthings. Many are described as playing with them as if fascinated by strange, newly-discovered toys. They pick them up and try to throw them away, or out of the cradle, or bring them to the mouth, where all things tend to go. Then comes the stage of toe-sucking, which sometimes as early as three months becomes persistent and troublesome.

¹See my "Notes on the Study of Infants," *Pedagogical Seminary*, Vol. I, p. 130.

In our record of sixteen marked cases eleven are with the left toe. The same experience of biting, as with the hands, often occurs, and the child perhaps cries with the pain many times before it really associates the bite and the ache. Sometimes this association seems to be marked by a distinct series of experiments, and some children old enough to talk express this newly-made experience by saying, "I bite and you hurt," or, "It aches when I bite." Our protocol contains the word "examine" twenty-seven times and "watch" thirty-three times to describe this special direction of attention. Children often handle their feet, pat and stroke them, offer them toys and the bottle, as if they, too, had an independent hunger to gratify an ego of their own.

The toes are a still more specialized class of playthings which are plucked and pulled, sometimes with signs of surprise that they cannot be played with like a rattle. Later yet comes the record of foot and toe movements made for the eye, marking probably the time when these motor impulses are associated with retinal impressions. Before the age of one year, children take pleasure in games with the mother or nurse which involve giving names of animals, etc., to each toe, as they do earlier with the fingers. Various foot games are often made a distinct event which is regularly expected at bed-time, in the morning, or at bath. Children often develop at this time a special interest in the feet of others, and examine, feel of them, etc., sometimes expressing surprise that the pinch of the mother's toe hurts her and not the child, or comparing their own and the feet of others point by point. Curious, too, are the intensifications of foot-consciousness throughout the early years of childhood whenever children have the exceptional privilege of going barefoot, or have new shoes. The feet are often apostrophized, punished, beaten sometimes to the point of pain for breaking things, throwing the child down, etc. Several children have habits, which reach great intensity and then vanish, of touching or tickling the feet, with gales of laughter, and a few are described as showing an almost morbid reluctance to wear anything upon the feet, or even to having them touched by others, so that they must perhaps be washed by force or strategy. The common habit of lying upon the back and tramping the soles against a vertical wall, as if to anticipate walking, seems sometimes to have a period of special intensification. Three babies, otherwise normal, used their toes for grasping playthings and block-building so exclusively that they had to be coerced to use their hands instead. Others acquire the trick of rubbing the feet together with expressions of great glee, as older people rub the hands together. Several almost fell in

love with the great toe or the little one, especially admiring some crease or dimple in it, dressing it in some rag of silk or bit of ribbon, or cut off glove fingers, winding it with string, prolonging it by tying on bits of wood. Stroking the feet of others, especially if they are shapely, often becomes almost a passion with young children, and several adults confess a survival of the same impulse which it is an exquisite pleasure to gratify. The interest of some mothers in babies' toes, the expressions of which are esthetic and almost incredible, is a factor of great importance. On the whole one cannot read these plain and homely data without querying whether some of these exacerbations of this group of experiences may be laying some of the psycho-physical foundations for the foot fetichisms which may later appear in degenerates after the dawn of sexual maturity.

Twenty-three returns show that infants of thirteen to fifteen months of age sometimes have a special period of being interested in their own knees, and one society of school girls adopted the custom of wearing rings on the toes as their distinctive badge. Throwing or pulling both toes and fingers out of joint and making them crack is a frequent fad of school life.

Next in order comes acquaintance with the ear. Some infants of only three or four months of age develop troublesome habits of pulling their own ears, perhaps while nursing; others pull and sometimes scratch them repeatedly till they cry and the ear bleeds. Several children of six to ten months cannot sleep without feeling their own ear; three want it folded up and tucked into the meatus; four cannot nurse without feeling the mother's ear; a few form the habit of seizing all ears within reach, or, perhaps more particularly, those of the cat or dog. Some form of this habit often persists for years. A girl of four incessantly feels of her ears, each with both hands, fearing they may be lost. Children occasionally suffer from fears, probably often suggested, of almost morbid intensity and often of years' duration, lest their ears are growing too large or small, or taking on the shape of those of an animal, or may become hard or bone-like, or droop like a wet rag. A girl of eleven has a veritable passion for pulling, feeling, or touching her own ears and those of her friends. Four young ladies of high school age confess to a fad for ears; are chiefly interested in that organ in all strangers, get impressions of character from its shape or color. Some state that nothing could overcome the effect of bad ears for their affections. Some wish to feel the ears of all their friends. Some children persistently shake the head like a dog to feel the ears move, or try to cultivate the power of moving them

with the scalp muscles like the horse. Others incessantly pull them out or turn them toward the front at night, that they may stand out from the head, or else stretch and flatten them, or pull the lower part down, and every one has enjoyed stopping the ears and opening them with the hands, perhaps alternately. This, of course, only occurs after the child has learned, or it may mark, the first consciousness that hearing is associated with the ear. Children often think they hear with eyes, feet, or hands. Many children have a strong impulse to push everything possible into the ear, from which habit, as physicians know, dangerous results may follow. On the other hand there are often fears almost of morbid intensity lest some insect should penetrate the ears, or perhaps the devil's darning-needle pass in at one and through the head out of the other. The specific noise hunger often comes before it is associated with the ear, and as it is well known prompts infants often to pound things and make a din which is distracting for adults.

The nose in many children, although less often than the ear, has a more or less marked advent in infantile consciousness, and some children exhibit a very distinct period of interest in it. Although it is rarely large enough to be grasped, it is felt and with marked signs of curiosity, and sometimes pulled and rubbed by the child in an investigating way. The familiar adult trick of pretending to pull it off may account for the fears of some children that it may be lost. Children often try to make it longer or shorter. One permanently deformed her nose by pressing and pounding it against the head-board of her bed so it should not turn up. The nostrils often excite distinct attention, but in this respect, as well as in the propensity to explore with the fingers or stuff things into them, are not unlike the ear. From our far too meager data it would appear that the average age when children learn to associate sensations of smell with its organ is about three months. Then they begin consciously and ostentatiously to sniff and smell, and sometimes to explore the nostrils.

The hand is known or sensed by the mouth, the other hand and the eye; the foot by the hand and eye, and very little by the other foot; the ear by the hand only; and the eye is known by no other sense save very slightly by touch, and is the last as well as the highest sense to become objectified.

The first object to hold the wandering gaze of the newborn child is its mother's eye. The eyes are throughout early childhood the centres of chief fascination, so that it is strange that children often know almost nothing of their own eyes. Many children from three to five months think that their own eyes, unlike those of others, are always closed because they

find them so when touched, and some describe it as a misfortune or deformity that they are doomed to see by squinting with difficulty through the lids, so that when the mirror is seen and understood there is often surprise to find they are open. Many children spend much time before a glass studying their own eyes, and develop a fad for examining the color or watching the movements of the eye-balls and lids of other people. Whether it is the motion, the glitter of the reflected light, or the concentric arrangement of iris and pupil, it is hard to determine, but interest in eyes is so primitive and strong as to suggest the need of further special consideration of this point. Infants have often an instinctive propensity to thrust their fingers into other people's eyes, either to feel of them or to see them shut. The bright point reflected from the ball is often thought to be an agent in seeing, which is sometimes thought to be but emitted light. Yet children often become discriminative of large or small, prominent or depressed, but particularly sharp and fixed or rolling eyes. Pictures sometimes have to be removed from nurseries and kindergartens because the eyes haunt sensitive children. The eye seems to be one of the very first media along with touch through which the child comes into rapport with the parent; even older children always gaze at the eye rather than the mouth of others and take at first far more meaning from it than they gather from words. They are very susceptible to eyebrows, expression around the eyes, and generally fear big or glass eyes. When consciousness has once grappled with the eye it is often felt, pressed, rabbed the lids sometimes manipulated, and the child almost seems to be studying pressure-phosphenes, when it is probably intent only upon learning the pain threshold for all these manipulations. It may well be doubted whether Socrates, if he could have done what he claimed to be able to do, viz., turn his prominent eyes inward till each gazed full into the other across the narrow bridge of his nose, would have added to his self-consciousness thereby; but children are often persistently prone to squint the eyes inward, gaze at the point of their nose, eyebrows, hair or tongue until in positive danger of becoming cross-eyed. This, however, is only one of the many eye-gymnastics of childhood. The eyes are zigzagged vertically and horizontally rolled up and down to the extreme limits, gyrated and winking habits almost to the point of nystagmus are formed. The eyes are alternately closed and opened, and several children in our returns take pleasure in attempting to go for hours, and even days, with one eye partly or wholly closed, and sometimes both, in imitation of blindness. Eye affectations would form almost a

chapter by themselves; the modes of casting them down or up, making eyes, looking coyly askance or glancing quickly, trying to make them snap, flash, shine and reflect all the fluctuating moods and whims of juvenile instability of soul, are well known. The eyes, perhaps even more than the hands, feet and mouth, seem to be the centre of that kind of self-consciousness which is always mindful of how the self appears to others, and what to do with the eyes in the presence of strangers is a more difficult problem at the awkward age than what to do with the hands and feet. Finally must be mentioned the very common impression of young children that if the eyes are covered or closed they cannot be seen. Some think the entire body thus vanishes from sight of others, some that head also ceases to be visible, and a still higher form of this curious psychoses is that when they are closed the soul cannot be seen.

The hair is a special object of interest with infants, which begins often in the latter part of the first year, and depends much upon its abundance. Infants must learn also that a too drastic treatment of this part of their personality causes pain. In very early infancy the propensity to clutch the hair or beard of adults and, especially having grasped it, to cling with almost convulsive intensity, suggests the obvious atavistic relation to the necessity for anthropoids of arboreal habit to cling to the shaggy sides of their parents. Some deliberately try to pull it out. One cannot doubt from these returns that many, if not most, children have a distinct period of first noticing the hair, and that it may be for days or weeks an object of prominent interest. It is clutched and pulled, stroked, and more often persistently rubbed, occasionally till it is worn off at some favorite and accessible point. Some develop, perhaps from the pain of combing out snarls, a morbid horror of having it touched, which may become of convulsive intensity. Some children take pleasure in stroking or "pooring" it, especially when they feel happy, or are good or praised, and pull it madly when in anger. When it is long enough it is often chewed, sucked, bitten off, and three cases are described of children who have shown a marked propensity to pull out their hair as if by some trace of the atavistic instinct which has caused the depilation of the human body. The hair, no doubt, gives quite unique tactile sensations, both in its own roots and to hands, and is plastic and yielding to the motor sense, so that the earliest interest may be akin to that in fur, which is a marked object in infant experience. Some children develop an almost fetishistic propensity to pull or later to stroke the hair or beard of every one with whom they come in contact; but it is not until well

into the second year that the average child develops rudiments of pleasure in or even consciousness of the coiffure.

Teeth are sometimes a terrible object to infants, like big eyes, but like all feared objects there is later a special interest in them as fear is gradually overcome. When the first teeth appear, there is, of course, great sensitiveness in the gums, but also distinct interest. The propensity to bite everything is at first a blind instinct in the service of the process of cutting through the gums; but when a few teeth appear there is a revival of the early mouth consciousness and everything is bitten as everything used to be sucked. The first teeth may cause as much perturbation of consciousness as the first trousers or boots. Children may incorporate in their prayers thanks to the good Lord for giving them teeth. They are felt of and sometimes shown, and their imprint is occasionally left not only upon objects, but upon the persons of others as well as upon themselves. Sometimes children bite their own flesh severely, as if they did not realize how much more effective their jaws have become. There is a long list of cases of children who have bitten each other, or even toys in anger at this stage, suggesting that along with the teeth there is also growing the strong psychic disposition to use them as primitive animals do theirs. Children sometimes come to be particularly observant of the teeth of other children, and these, like the eyes and other organs, may become very important in mediating likes and dislikes, especially toward adults. The mouths of their parents are explored, and perhaps their own teeth studied in a mirror. When the milk teeth loosen and are removed and others take their place, there is great interest in the general subject of teeth, and there are sometimes volleys and batteries of questions concerning the teeth of animals and insects, God, etc. Teeth with gold fillings are often an object of great interest or admiration.

Less prominent than any of the above in our returns are a few other miscellaneous parts. It is surprising to see how small and late is the attention given to sex. While in several cases apparently morbid these organs early assume great prominence in consciousness, and sometimes even vicious propensities occur in the first year, the normal child sees and cares little about them. Questions are often asked, but receive answers which easily satisfy the curiosity and minimize interest. Sixty-three girls expected when they were older to be boys, and fourteen boys to be girls. This change, however, involved no thought of organs, but mainly only of dress. Almost the same might be said of navel and nipples. While a brief chapter could be written upon the consciousness of these parts, it would be largely morbid and, though

full of psychological interest, is aside from our purpose here. The act and products of excretions by bladder and bowels is often an object of interest hardly less intense for a time than eating and drinking, and many scatalogical rites of savages are suggested as paralleled by acts which cannot be recorded here.

The tongue is a magnet for the attention of young children, and it is often felt of, pulled, protruded, made into all shapes, and used for various clicks and noises. Some children develop acute fears of swallowing the tongue or losing it. It is curious to note the literalism displayed by some who, having heard the epithets especially applied to it, fear it will cut or bite, and attempt to punish it for insubordination, or later for lying. A boy of four, severely censured for untruth, was seen pulling at his tongue with the purpose of tearing it out, and succeeded in drawing blood. Tongue-touching is a game, and children often challenge each other to touch icy, nauseous or other substances to it. Some children insist on licking the cheeks, necks, hands of those they wish to caress; having cats, dogs, horses and cows lick their face. The disposition to lap, not only solid objects of food but also liquids, is persistent in some children, and not a few have a special period of interest in seeing and occasionally feeling the tongues of other children and even of animals: to have the smallest tongue is sometimes a desideratum among groups of little girls, whose form of speech may be influenced by this affectation. When tongue consciousness is at its height children sometimes affect peculiar positions of it and may press the tongue between the slightly opened teeth in smiling, or give it other positions that affect the facial expression in a laugh. Tongues certainly differ much in mobility, and in some children they can be made to assume a great and surprising variety of positions. Closely connected, too, are the early forms of voice consciousness, when every quality of tone is made, high and low, loud and soft, aspirate and vocal, clicks, gutturals, prolonged and staccato, tremulo and steady imitations of sounds of notes, wind, ears, cries of all animals and of babies.

The nails of toes, and particularly fingers, are attended to not uniformly, but at times much accented in consciousness, and there may be great dread of having them cut or even examined. They are gazed at, felt of, pulled, bitten, and some children develop a strange propensity for scratching. Occasionally this propensity is directed toward most objects of touch and is a part of the exploration of the objects of the environment. Things are not known when seen and touched alone, but must be scratched. The sensations thus given are unique, and are a class by themselves. A German medical

writer has advised that the finger-nails of children should be kept not so long that bacteria can accumulate under them, but not so short but that these sensations can have due development. The propensity to scratch faces in anger is in some children intense and cat-like, so that it becomes imperative to have special care of their nails, to avoid danger. Several girls in our returns develop a sensitiveness, which is probably morbid, against the least roughness of the nail-tips which give them symptoms akin to horripilation, and one child had a morbid propensity, sometimes seen in insanity and anesthesia, to thrust slivers and other small objects under the nails.

Many cases of special attention to miscellaneous parts of the body were noted. Some children show a special consciousness of their shoulders, chin, the size and form of their mouth, the ankle, wrist, neck, and any defect or abnormality is certain to be the seat of acute self-consciousness. Perhaps the propensity of making faces is one aspect of growing self-consciousness, and if so, the disposition to twist and distort every joint into extreme positions, both actively and passively, no doubt helps on this development.

In fine the ego may be first roughly conceived as all that is within the skin, and the non-ego as all outside it. Many subtle, unanswerable questions have been asked, what parts of the cell are vital and active and what are passive, dead, or products of decomposition; when is food completely assimilated and really a part of the physical ego? In a sense all we own is part of the psychic ego, but in a sense food that is swallowed has only entered a tube that passes through the physical self, and is as objective to it as if applied to an external surface. The infant has to learn by slow steps the contours of his personality; beginning with the more mobile parts, the trunk is least and last known, and children are well on toward school age before they have a definite conception of the unseen and especially of the unfelt parts of the body, as witness the frequent neglect of boys to care for the hair on the back of the head. Drawings which always represent the head and limbs, then perhaps fingers and toes, and last the body, are thus a fair index of this progress.

II. Within the surface, the child's somatic consciousness does not at first penetrate. The skin is often pinched, pulled, scratched and otherwise explored; but is never thought of as a continuous limiting surface, at first, but later such questions as, "Could I jump out of it and another get in?" "Would it fit, stretch, shrink?" etc. "How could I get out of it?" "How would I look?" etc., are common. Much washing and rubbing develop the dermal consciousness, and in several

returns even itching and scratching provoke special attention to the skin. Children often take much satisfaction in stroking and "pooring" themselves and other persons, and if nervous acquire extreme sensitiveness to any degree of roughness. The most marked dermal impressions throughout childhood are thermal.

At the age of from 3 to 5 the bones are generally noticed, and there are many questions concerning the hard things under the skin. Some think them wood, iron, stone, etc. On learning that they are bone there are many flitting fears, sometimes that they will break or that dogs or other animals who love bones will eat them, or again that they have a horrid skeleton inside them, and there are many curious forms of weird bone fancies and scores of questions as to their purpose, material, size and shape. Often the knee-pan is the first bone in our returns to become an object of special interest; next comes the elbow, and then the wrist and joints. Bones are generally the first and for a time the chief object of curiosity within the body, and the discovery that cats and dogs have bones is often an event, and their size is often vastly magnified, and their shape curiously discussed.

Next comes the stomach. Its sensations of plethora and often pain, its associations with food and drink, are early. Many children believe that the entire internal body save the bones is a receptacle for food, and that it fills arms and legs, so that if the skin were anywhere cut, food would be found to be the stuffing. Some believe it hardens directly into bone. Often whims concerning appetite have affiliations with the weirdest kind of ideas of the alimentary tract. Many children conceive of the body as stuffed with saw-dust or with cotton like a pin-cushion, or with dust of which man was made, or else sweepings. On pricking or injuring the skin and seeing blood, many form the idea, often no doubt from inadequate answers to their questions, that the entire body is a skin or bag filled with blood and if it is tapped blood will gush out and the body collapse like a balloon. They often notice the pulsations of the heart and think some one is pounding inside them, and may even develop a definite image of how the man looks and how he strikes. Few organs inside the body excite so much curiosity as the heart, but the questions show that this is in large part due to its association with life and the soul, which is often identified with it even in form. Upon noticing the activity of respiration children almost always begin to experiment; they exhale all the residual breath possible and inhale a maximal amount, breathe as fast as possible and as slow, experiment with costal and abdominal modes, and particularly hold the breath often in

rivalry with each other, the higher centres thus learning control of the reflex apparatus. Very many, too, are the questions—"Why do we breathe?" "Do animals, plants, God, etc., breathe?" "What is breath?" There are many morbid fears lest respiration should accidentally stop, and many children resolve to lie awake to prevent this calamity. At this time the elaustraphobias may take their rise, and there develops unusual dread of being hugged, choked, smothered in close places, being shut into closets, trunks, etc. Some have for a long time the conception that the body is a bag of wind, and some children are panic-stricken on seeing their breath on a frosty morning, thinking the soul is escaping. Perhaps there was some truth in the antique conception that dreams objectified this function, and when in nightmare we seem to flutter and hover, it is the lungs which play the stimulating rôle and suggest the thought of wings.

It is a revelation of great significance if this inward direction of thought has been aroused to learn what the country boy finds out on butchering day. Such experiences, although slight and without demonstration, cause a great and wholesome readjustment of this aspect of self-consciousness by showing both the nature and the relation of the parts within. The two most frequent questions throughout are, first, "Why have I stomach, eyes, hands?" etc., or a question seeking purpose and use; and secondly; "Have other human beings or animals the same organs?" And to realize that parents, playmates, or dog, horse and cow have legs, eyes, teeth, ears, stomach and heart as they have, always excites interest and pleasure. No child, of course, has all these experiences in the foreground of its consciousness, but all have some, and doubtless pass through, some more and some less consciously, all these phases, the definite order of most of which still remains to be determined. The internal sensations and conceptions are, as we shall see later, those most intimately associated with childish conceptions of the soul.

III. The third element in the child's consciousness, but not usually included as a factor of the ego, but which must not be neglected, and on which our returns are voluminous, is dress and adornment. Rings for fingers or ears, shoes and gloves attract the child's attention to the part involved, and a change of dress often involves change of disposition, and almost character. During the second year this is often strongly developed. Corresponding perhaps to the prominent position of the foot in the infantile consciousness, a new pair of shoes seems quite as important as a new dress. Far later, too, gloves come into great prominence. Very striking with young

children is the charm of some single and perhaps small feature, as, *e. g.*, a pair of shoes with buckles, stockings with clocks, jacket with bright buttons, a hat with a feather, a bit of fur here or ribbon there, a sash with buckle. So, too, the first pocket, the first trousers, suspenders, long pants or dress, first watch, parasol, muff, gloves, ring, necklace, standing collar, perfumery, new ways of wearing the hair, the first belt, breastpin, veil,—all these stand out in memory in the most vivid way, and have played an important rôle in the education of self-consciousness. The passion to have new things noticed, which often makes children so ridiculous, seems sometimes strongest to strangers and sometimes towards friends. This seems to mark an important moral distinction. For most girls all new articles of dress and ornament become doubly dear if liked or admired by those they know and love best, and lose their charm if the latter do not care for them.

Lotze rather curiously thought he had done for personal adornment a service comparable to what Kepler had done for astronomy by his three laws, in which he believed he had explained man's satisfaction in dress. If we touch an object with a stick, we instinctively analyze our sensations into those felt by contact of the hand with the stick, and ascribe the rest to the object at the other end of it. It gives us thus a peculiar pleasure when consciousness runs through all that touches us, and this we feel in those articles of attire that lengthen the body by prolongations of our personality at the head or feet—high shoes, stilts, hats, head-dress, etc. He thinks that all these forms of feeling change with every change of their height and form, which shifts the centre of gravity, and there is special satisfaction when equilibrium is the least trifle in danger. We feel the wind or our own motions by very different sensations in hats that are high, broad, obliquely placed, or heavy. Secondly, all hanging, fluttering or swinging garments, by their change of tension in different directions, cause us to feel ourselves most agreeably in the peripheral tract or graceful curves of their free moving ends: a trail dragging along the earth is like a new organ, endowing us with a new sense. Rings, ribbons, ear-rings, watches, sashes and everything that hangs and dangles are worn especially by the young, not so much for display as to gratify the exquisite pressure sense so peculiar to them and which, according to the modern fashions, free, flowing hair no longer does. Lastly the impressions we derive from our own clothing and its strength, stiffness or thickness our self-feeling imputes to the form or poise of our own body. The pressure of a corset, Lotze thinks, awakens the feeling of a stronger and

more elastic existence; so girdles, bracelets, and above all the first pair of trousers with suspenders gives a pleasing sense of sturdy inflexibility, and uprightness. If this view is correct it follows that we admire the folds of a graceful, well-fitting garment, not for its beauty, but that we unconsciously reproduce in ourselves the agreeable sensation of the wearer's body. So the false arm or leg half deceives even the wearer as to the boundaries of his own corporeal existence.

This view is very extreme. The great pleasure in wearing new and beautiful objects of attire in childhood is to secure thereby the attention and interest of others. Our returns abound in accounts of children who display and protrude new articles of dress, or call attention to them in the most vain and laughable way. Moreover the fact that even children will wear thin clothes when heavy ones would be far more comfortable, shoes that are too small for the sake of looks, and garments that are uncomfortably tight or thin in places, shows the dominiance of those functions which Lotze disregards. The chief question is, and especially with girls, not how attire feels, but how it looks, and this standpoint dominates often in those garments that are not seen. The child who is habitually well dressed learns to avoid acts and environments which tend to soil his clothes and may become dainty, finical, fastidious and effeminate. The child who is rudely and poorly dressed, on the other hand, comes in closer contact with the world about him and acquires a knowledge more real and substantial. It is difficult to determine which pleasure is the greater, that of habitually well dressed children when very exceptionally allowed to put on old garments that cannot be injured and to strip head and feet and abandon themselves to the natural freedom thus given, or of very poorly clad children who by some good fortune are provided with attire that enables them to feel the great luxury of being well dressed. Children sometimes develop an insistent impulse to strip off parts of and occasionally all of their clothing, partly from sheer discomfort. Pants as usually made are an euphysiological and unhygienic garment, and much might be said in favor of a more rational dress for hips and thighs. There are cases of persistent denudations in childhood that are morbid and atavistic. Of the three functions of clothes, protection, ornament and Lotzean self-feeling, we must, I think, conclude that while the first is more important, the last is most infrequent and the second by far the most conspicuous in childhood. Many mention a corroding kind of self-pity with which they regard an old garment after it has been superseded by a newer and better

one, and others preserve for themselves and later for their children all the articles of the dress of childhood and infancy, and regard them later with feelings curiously described, and no doubt still more curiously mingled. That, however, man's primitive body consciousness has been largely disguised and translated into clothes-consciousness, there can be no doubt. The comfort of clean garments, sensitiveness to texture and thickness, flexibility and fit are elements which are no doubt always present, and Lotze has done a real service in showing us that clothes are an integral part of our self-consciousness. The love of wearing the dress of adults may be interpreted thus, but clothes are at best alter ego and also in part mask and distort the primal sense of the physical self. Cleanliness of body like clean dress has a prodigious moral effect on children, who change manners, temper, conduct, and put on a better self after being well washed. A wise application of clothes—psychology can do very much in rightly poising a child at the golden mean between too much and too little self-consciousness if not between excessive shyness and over-boldness.

IV. The mirror is a factor of great importance in this connection, for to it childhood owes a far more definite and visual image of its own form, feature, attire, acts, etc. It enables man, as primitive reflections in water did not, to see himself as others see him, and along with photography has given to self-consciousness a far more detailed objective and real form. The images thus seen are not like shadows and dimmer reflections thought to be soul-like, but are like the real physical self. We owe to this source a more exact and abiding impression of whether we are beautiful or ugly in feature, contour, complexion or action, and can rank ourselves more impartially in comparison with others. This knowledge may act as fatalistic discouragement or be the basis of a rank conceit; but its presence is an element of great importance. Many children inquire concerning their own beauty or attractiveness, feature by feature, of mother and mates, and it must be admitted that no true mirror or photographic plate is proof against the effects of flattery. Young children, if held before the glass when angry or crying, often change to laughter. Many hold long conversations with their reflection, addressing themselves in the second person. Some correspondents regret the invention of the mirror, but more think every one should occasionally study his own features, complexion, smile, gait, bow and other common acts, or insist that all should habitually see their entire figure behind, as well as before, in order to know self better, both for their own sake and that of their friends.

V. The names by which children are known are a factor of consequence in the early sense of self.

In response to the request to write every designation applied to children, not omitting the silliest effusions of maternal tenderness, 780 different terms were received. Of these 54 were usually applied with the prefix little, 14 with the prefix old, 5 with young, 13 with mamma's and 9 with papa's. The majority of these appellations appeared only once, but some were repeated many times. The favorite epithet was Pet, which was returned 52 times; then come Darling 49 times, Baby 41, Honey 31, Sweetheart 31, Sweetness 30, Kid 27, Sugar-plum 23, Brat, Dumpling, Tootsy-Wootsy, each 20; Bub 19, Sissy 16, Angel and Ducky, each 15; Birdy, Chatterbox, Puss, Pudding, Chicken, each 13; Precious and Dolly, each 12; Rascal and Popsy-Wopsy, each 10; Daisy, Fatty, Kittie, each 9; Lamb and Sonny, each 8; Jewel, Girlie, Bibbie, Dearie, Sunbeam, each 7; Monkey, Mischief, Midget, Rosebud, each 6; Sweetmeat 5, Bunnie, Dicky, Curly-head, Cry-baby, Nuisance, each 4; etc.

Among the pet names applied to babies those of animals are very common. They are called ape, monkey, coon, kid, pig, Billy and Nanny goat, kittie, puss, pup, rat, calf, mouse, tit-mouse, dormouse, cow, horsie, chipmunk, salamander, turtle, lamb and lambkin, periwinkle, pollywog, mink, oyster, crab, goosie, chick, dove, duck, cuckoo, tomtit, robin, bobolink, chickadee, pigeon, blackbird, crow, jaybird.

Names from the vegetable kingdom are common, such as apple-blossom, apple-dumpling, apple-core, apple-cart, sweet apple, pippin, peach, turnip, hazel, comfrey, pumpkin, strawberry, bud, blossom, pink, daisy, honeysuckle, tulip, buttercup, poppy, dandelion, sun-flower, peony, heartsease, bean-stalk, chickweed, bluebell, harebell, Mayflower, peep-o'-day.

Babies are often named from some part of the body or from some physical trait, as snoopy, bow-legs, thumbkin, bony-legs, fatty, neck, elbow, shorty, skinny, babeskin, brick-top, runt, curly-head, frowzletop, bushel, bundle, blue-eyes, bright-eyes, warty, reddy, shinny-bone, hair-pin, clothes-pin, tuning-fork, tow-head, lumpy, chub, slab-sides, snow-ball, pinkie, nigger, golden-hair, pug, butter-ball, buster, broom-stick, bean-pole, browney.

Even dress and other externals may suggest names, as boots, pants, buttons, smutty, shirtie, buttermilk, milksoop, scarecrow, gig-lamps.

Character appears in such terms as old sober-sides, touch-me-not, cry-baby, crank, busy-body, blarney, high-flyer, dude, dirt, fraid-eat, girl-boy, pert, Miss Independence, Miss Giddy,

Miss Contrary, mutton-head, jade, chump, trot, yahoo, moper, harum-scarum, tricksy, sauce-box, wretch, villain, rascal, vixen, varmint, torment, tease, tender-heart, piety, tramp, trump, numb-skull, cross-patch, charmer, scaliwag, humbug, wild-fire, clod-hopper, romp, sunshine, smartie, sorry, sugar, cold-molasses, stick-in-the-mud, skin-flint, tom-boy, tell-tale, zany, Miss Sarcasm, lucky, slob, pest, Puritan, minx, nin-cumpoop, long-tongue, hussy, lunatic, pesky.

Closely related to the above come names suggesting characteristic acts, as wobbler, patticake, snoozer, chatterbox, trombone, tot, toddles, toddlekins, sticking-plaster, sucker, tumble-boý, bunter, rooter, bottle-boy, soap-sides, sot, snug, sozzle, sneak, lob, jabberer, music-box, hee-haw, cuddler, butter-fingers, squaker, squeaker, noisy (because so silent).

Names suggesting food and the sense of taste were common, as honey, sweetness, sweetie, sweet, sugar-plum, bun, sugar, dumpling, yum-yum, cake, sweet-meat, mint-drop, cream-cheese, chocolate-cream.

Repetitive and alliterative terms which appear in these returns are lovey-dovey, roly-poly, kit-cat, hun-pun, airy-fairy, unky-dunky, tootsy-wootsy, popsy-wopsy, flim-flam, hodge-podge, nizzle-nozzle, soft-snap, bed-boy, bottle-boy, piggy-wiggy, nipperty-tuck, buz-fuz, till-the-bell, the October-will, mumblety-peg, posey-woosy, lamie-wamie, orty-warty, highty-tighty, ducky-darling, bity-wity, enty-twenty, fibby-flab, etc.

Supernatural designations were angel, cupid, imp, devil, idol, phoenix, sphinx, spook, witch, cherub, puck.

Fictitious personages appear in, *e. g.*, Annie Rooney, Bill Nye, Dodo, Miss Muffet, Little Boy Blue, Humpty-Dumpty, Uncle Sam, John Bull, Dick Turpin, Two-Shoes, Topsy, Queen Bess, Hop-o'-My-Thumb, Punch and Judy, Ouida, Old Joe Jenks, Ornary Jim, McGinty, Josh Billings, Dixie, Rob Roy.

Often proper names not their own are applied to children as pet terms, *e. g.*, Becky, Teddie, Polly, McGurdy, Pete, Gretchen, Molly, Sally, Bob, Pat, Peggy, Nancy, Ned, Loretta, Lib, Lizzie, Mosey, Jack, Jake. Often a string of these are applied to a child, as Betsey-Jane-Maria-Ann-Betsy-Rubbage-Burney. Changing and exchanging names with their friends so as to act and be another person for a while must have a significance which, suggestive as it is, we cannot fully explain.

Terms used with more reference to their sound or noises than to their meaning seem to be lolly-pops, snooks, weezy, bnggins, skeesncks, skeedunk, skité, coot, thimble-rigger, sniggle-fist, fiberty-gibbits, smuggie, chickapin, bodkin, slab-dab, fiddle-de-flumps, nobs, nibs, ninny-hammer, gicks, gibbits, pot-snap, dot.

Miscellaneous are aborigine, chum, cub, urchin, chap, thug, dew-drop, end, star, diamond, diamond ring, curiosity shop, zip, young kit, squab, pearl, lugs, snow-drop, gipsy, Indian, minee-meat, Godie-on-wheels, Jim-cracks, cash-cord, ex-post faeto, bow-wow, mamma's life, heart, sun, precious, jewel, bug-bear, cruddy, coddie, old-beeswax, tike, bitzen, swonk, buzey, gndgey, ducky-do, skidd-a-more, jusi, greaser, rag-baby.

Till the age of three one girl knew no other name than papa's devil. One girl was called dolly from resemblance to a certain doll till her true name was lost. At the age of nineteen one is still called baby by her grandfather. Mary called herself bay for baby, and it stuck to her as a young woman. Revilla was small and came to be called Minnie by all. One girl was called Jennie, till at the age of eight she ordered a change and would respond only to Ida, which became her name. Elizabeth used to call herself Liberty, and that is still her name at the age of nineteen. Till eight one had no name but sissy. A girl of thirteen knows no name but stick-in-the-mud, given her by her father. At the age of five Rose became cross if not called Ella, and Ella she became. A girl of twelve had no name but sweet, when she chose Anna Julia; and a boy sixteen, reared by a wealthy aunt, has no name but goody. Two twins had no name but baby till five, although often distinguished by the descriptive epithets warts and reddy. A girl ran away to Mr. Wetzelsterns, and was called Peggy W. up to the age of ten. Till the age of eleven one had no name but boy. Sometimes when they begin to write and go to school, or at the latest in the early teens, such children begin to feel the want of a real name. Children occasionally swap names, or one takes the other's name; one, e. g., becoming Ida I and the other Ida II. Humorous names suggested for twins were Pete and Repeater, Max and Climax, Kate and Duplicate, etc.

Diminutives concentrate attention to a more intense foeus, and every language has them. Adolescent girls torture their names, and often give themselves new ones, especially to add a characteristic *ie* to an appellation for the exclusive use of their most intimate friends, somewhat as Germans use *du* in place of *Sie*, or the French *tu* for *vous*, and secret names for the dearest friends are common. Boys, on the other hand, tend to rnder nicknames. A new boy who called all his schoolmates Thomas, James, William, instead of Tom, Jim, Billy, was voted a prig, and generally disliked. There is something wrong with the head or heart of parents who make a point of calling their children Elizabeth, Margaret, Sophia, Robertus, etc., from infancy, as do a small but *ultra* respec-

table minority of our correspondents, and as do a few of the most proper kindergartners. Ultra-saccharine and nauseating as some of the above epithets seem to the adult consciousness, their copiousness suggests the many-sidedness of childhood, when more than at any other period the manifold qualities of the race appear in the individual, and every new pet name is a new channel opened for new parental feelings. Love, whether during the honeymoon or in the golden dawn of true motherhood of soul as well as of body, still reveals to us a glimpse of the primeval impulse that gave birth to names, and that was perhaps one of the chief sources of language itself. Many of these designations reflect in the clearest mirror which speech can command traits of body, acts, disposition, etc., that help the child to new points of view of self before his ensemble of parts is labeled by a single conventionalized name that has lost all its appellative root meaning.

Guppy, Bardsley, Barber, Long, Dorsey and other investigators of proper names show that everywhere personal names preceded all others, that in England second names were almost unknown among the yeomanry before the Norman conquest, and that everywhere there was once a time when everyone knew the meaning of their own and others' names. Much primitive history can be reconstructed by a study of names, which sometimes spread from a single centre and enable the expert to solve problems where a study of race and language fails, so that it has even been said that boundaries like those of Alsace and Lorraine could best be determined thus. Names in open and accessible regions are oldest: "hill countries contain the ethnological sweepings of the plains"; the slow rise of woman is marked by a great dearth of female names, save those formed by feminine endings to the names of males. Places, family, great guild-industries like the cloth trade, moral, mental and physical traits, flowers and animals, landscape features, rank, office, mythology, war, priest-craft are found to be the etymological root-meanings of nearly all names. Among modern and western people local names abound, but are rare in the Orient, and almost never occur among plain-dwellers, like the Arabs. Most personal names were at first generic, expressing some property common to many individuals. The rise of industries, life amidst strongly diversified scenery, the development of religion, social and political organization, and wider knowledge generally unfolded or ever larger number and variety of names, till now with all these resources and a vast international repertory to draw from, together with the practice of assigning several names, almost every individual in a large community can have a unique and only name. The conventionalization and arbitrariness of

most proper names open the way again to euphony of sound, weird fancies, associations, and even to superstitions, which may in part explain the frequent sudden wonder that in the most unexpected way sometimes befalls children who feel themselves looking at, thinking or saying their own names and automatically and almost imperatively querying: "Why am I John or Henry? what does it mean? how strange and funny! how different would I be if I was Edward or Robert? what is John anyhow? have I, or could I have another more real or fit name? how should I live up to John?" Often some human quality is assigned to the sound or the look of the printed word. A student, *e. g.*, named McIntire, thought the head on his name too large for the body, that he should be making tires, was tired, should somehow be whole or entire, rejoiced that his narrow escape from being McGinty was a safe and sure one, thought the name was his by some accident and was meant for some other person, felt it insufferably tedious to bear forever, perhaps in eternity, the same tiresome name, that he must exchange it or somehow break away from association with so arbitrary and mysterious a symbol, or that it was a banner, and his life work was to plant it on some topmost pinnacle of fame and make it spoken with awe by an admiring world: all this in an intense, only half-conscious, reverie-like way.

VI. Most children conceive the soul or self in some particular form. (a) In Mr. Street's returns, above referred to, 144 thought it shaped like the body, as it is in many additional and supplementary returns to my own questionnaire. It is thin, ghost-like, perhaps bluish, or light gray; may be made of mist, fog, smoke, cloud, breath, gas, vapor; is often transparent; draped, but rarely colored; light enough to float; subtle enough to pass through walls, and sometimes with an aura of dread or physical chill. It is akin to shadow or the dim reflection in water which primitive man often identified with the soul; and it may be a baby, a giant, or small as the image in the eye.

(b) Many children conceive the soul as like some part of the body. For most of these it is heart-shaped, a heart in the heart; perhaps smaller, invisible, or else a special part of the heart, or a second heart above, beside, or set in the wall of the fleshy heart. For others, the soul is just red blood; for others, the stomach or abdomen shaped like a round bowl. A few make it the liver, a tongue perhaps of fire, a particular bone, lungs, brain, sexual organ, navel, the skin with nothing or air in it, phlegm and liable to be coughed up and partly or wholly lost; and some conceive it as a head with wings, an eye, a beautiful, perhaps trans-

parent, or jewel-like hand, or a pointing finger, or more often a foot of wondrous form and tint, or its sole (suggested by soul), or something set in or inside of a foot. For some it is the skeleton that goes to heaven or hell.

(c) Next in frequency come animal forms. The soul is conceived as a dove, butterfly, eagle, turtle, mouse, worm, caterpillar, snake, spider, cat, hawk, bird of paradise, maggot, lion, wolf, as any chance analogy of sound or figure of speech may suggest. These forms are often associated with the quite prevalent idea of children that they may become or have been animals, and less often with their propensity to imitate their acts or noises. On this head, as in so many others, the data are too meagre, but are full of interest, and suggest a tempting line for further research.

(d) The miscellaneous soul forms have a very wide range. Little girls often conceive the soul as a flower in full bloom dispensing fragrance—an image that may persist and undergo a high degree of refinement. It may be suggested by the child's name or some song or story. A stone either white or brightly colored, or a jewel of various size, shape and situation may do duty for soul. So may a glowing coal, a flickering, pale flame, or darting tongues of fire. Souls are stars, comets, winds, noises, clouds, not unlike those shown on a screen by Mrs. Besant, which are pink if in love, green if jealous, etc. They are fine lace, or soft, like velvet; good ones are white and bad ones black, with all intermediate shades of gray. Bubbles are souls, eructations, odors, particularly incense, suggesting Jäger's soul-smell; sparks from the fingers are parts of the soul, and lightning is new souls coming down from heaven. We hear souls in echoes, words, voice, and speech is soul, and so is animal heat. Souls may be egg-shaped, and in the exact middle of the body, made of liver and too large to get out of the mouth till it is greatly shrunk-en by illness or broken by calamity or accident. They are tissues, perhaps wrapped around the heart, on which acts, especially our bad ones, are written and can be read, or they are invisible and live in heaven, coming down to the body only at death. There may be several and, occasionally, many souls. Hartley Colridge used to describe his picture soul-echo soul and shadow soul. Not only in dreams, but in waking souls may wander far away and visit absent scenes, and may get lost, strayed or even stolen by some hocus-pocus. Our souls may hold close communion with not only God and the dead, but with the souls of animals and plants, but no case appears in our returns of this communion with thing-souls, although this is commonly thought to occur. At the age of ten Louisa Alcott imagined her mind as a round room

and the soul a winged animal in it. There were shelves for the thoughts, and the "goods" were kept in sight, while the "naughties" were locked up, but kept getting out. Some bright children, even as old as fifteen, not only have no idea of soul, but never thought of any such thing, and to do so seemed uncanny.

Many, if not most, of these views are products of suggestion of some sort from pictures, literal interpretations of figurative speech, accidents of experience that cannot be traced, etc.; but their form is also conditioned by the necessity for the child to think in concrete terms of sense. To conceive abstractly even heat, air, wind, echo, smell is hard. Psychologists have often urged that we must drop all physical forms of thought in conceiving the soul, and held that to give it shape, color, weight or place is idolatry or materialism, that not only every metaphor of sense which gave rise to the very names, psyche, soul, spirit, animus, must be diligently eliminated, but that the root principle of the self or ego has no relation to time or space. Such extreme purgation muddles thought and may make our science and its application to education mere verbal cram, destroy every real criterion for eliminating contradiction, and favors crass reactions like modern spiritism. It seems thus a problem of great pedagogical importance, quite apart from materialism versus idealism, what images and metaphors should be used as most consistent with each other, most flexible to express facts, and what, if any, of these survivals of childhood should be preserved, at least for a time, and which should be eliminated. Until we can have some, at least, general conception of what we are dealing with in soul science or in education, we are exposed to the most wasteful and contradictory theories and practices. Are we studying or teaching a ghost or a brain, a shadow or physiological structure, a blue heart, a flame or echo, a state, phrenological bumps, or all together? Can we have a hypothetical soul-stuff that can be thought into modern brain histology and physiology, without being exposed to the obvious objections to materialism? The crass idea of matter is giving way at every point to a dynamism far more subtle than any conceptions of spirit were or could possibly be up to recent decades, and the intricacies of neural cells and fibres, their chemical complexity and rapid metabolism should be expressed in some neo-monistic hypothesis of the soul that education needs to take the place of such rags and tatters of superstition as those described above, and which often persist into adult years as a heritage of childhood.

These infantile conceptions are not a permanent back-

ground, a totality of experience, a unity of any manifolds, not more real, but often less so than the most vulgar things of touch, are neither products of psychological interpretation nor of metaphysical thinking, so that it is natural for the well-equipped psychologist to feel that his first duty is a muck-running iconoclasm that seeks to make a waste *tabula rasa* of the beginner's mind. This, I believe, is wrong. He should, with young students, reverse certain current methods, and instead of discussing the ego last, as most psychologists now do, the wise teacher will begin here and exploit the views of savages, children, animism, the soul-theories and discussions of Plato and Aristotle; touch not without a trace of sympathy Jäger's smell theory; explain the doctrine of sensible species; soul nomenclature; describe the mythology of souls of fire, lightning, animals; utilize wisely modern and ancient spiritualism, views of theosophists, reincarnation and transmigration, burial customs, ideas of absorption, diffusion, traducian and other views of the origin of souls, the different ethnic conceptions of its post-mortem existence, and from these topics pass to pleasure, pain, fear, anger and other feelings with instinct in animals, then to intellect, and sense last. Thus the grosser residual concepts of childhood would be eliminated, anthropomorphism felt in all its universal and constraining power, and an attitude of mind more tolerant and sympathetic than critical would be favored. It has been a grave misfortune that psychology has so often started with a study of sensation which, whether theoretically or experimentally treated, has as its *pons asinorum* on the very threshold all the bewildering scruples concerning reality and the nature of knowledge. The place for this is nearer the end than the beginning of philosophy.

The soul has been "entified" in many ways. It has been regarded as a split-off part of the *primum mobile*, an emanation from God and co-substantial with Him, pre-existent in, or as a star, coming voluntarily, or being sent to earth to take on the clog of a body as a penance, transmigrating through many lives, created at a given moment and put into the embryo, or physically propagated in familiar traducian wise. Ancient materialism conceived it as the finest, lightest and most subtle and pervasive matter. In ontological periods it is deemed a substance in which its qualities inhere, a noumenal *thing in itself*—clad in its faculties or ideas as phenomena. In ages of fear or impending judgment, stress is laid upon its simplicity and incorruptibility, so that fire can not decompose it, and it could survive even the awful cosmic weather of some *dies iræ*. In the early days of the calculus, it was conceived as punctual or unextended, and now it is often de-

scribed as absolutely spaceless and timeless.¹ As combining these latter transcendental features, there never was anything so impossible in fact or hopeless to know. The monsters that children sometimes fancy that never could live are compounded of less incomensurate and contradictory attributes. Such a soul is not a mere jabberwock, but perhaps the most hopelessly hollow *flatus vocis* ever spoken, to lose which would not require Plato's windy day, and would be a wondrous gain to psychology.

Mental imagery for psychic processes has been greatly helped by neural concepts, although these are at present often confusing and inconsistent. Most common, perhaps, is just now the fashion of speaking of chemical molecules that are built up to a degree of complexity and by action reduced to a simpler state. But we have combined with this the thought form of the instability of a pyramid balanced or toppling on its apex, and also of loading and unloading, or discharging. These chemical concepts connect with Lays' phosphorescence, combustion, with the trophic background of life and mind, with products of decomposition, etc., and need careful and new elaboration. The days of Galvani and Volta, when even Humboldt printed two now obsolete volumes on the marvelous reanimation of tissue by electricity, have given us many thought forms, polarities, positive and negative, indifference point, long and short circuits, tension, conductivity, currents, etc., and are also helpful, but of a different order. Thirdly, the old idea of vibration still does service. In the days of Weber's long experiments with waves in his mercury

¹As one example, from many that could be cited, see President McCosh ("Psychology of the Cognitive Powers," p. 8 *et seq.*): "We are not to allow ourselves to look on mind itself, or any of its operations, as occupying space, as extended, or a figure as having weight, motion, or rest," etc.

This reminds me of a scheme, of an opposite but perhaps no more absurd character, which I tried years ago in a lecture but long since abandoned, as follows: A *psychomorph* is the space area within the body in which any kind of physical action or change occurs that is involved in a psychic activity. This generic term covers all changes in muscles, glands, nerve cells, fibres, blood vessels, etc., but does not include external concomitants, as radiant heat, electric changes, and still less any alleged telepathic effects. A psychomorph, in other words, is the figure in space that would be stained by some reagent, if such can be imagined, that should paint the locus of all these changes as litmus paper reacts to acid and alkali, or, if all psychoses left their trace through the soma, like retinal purple. Of course localization has not progressed so far as to define very accurately this space for any single act or class of activities, although some pathological delimitations approach it, and it was only intended to emphasize a protest against the maddening surd of hyper-spatial and non-positional soul concepts. A *neuromorph* is the neural part of the more holophrastic psychomorph.

trough at Leipzig, a sine oscillation was almost thought to be the key of the universe, and Hartley's idea, sometimes strangely commingled with a perhaps Platonic concept of the soul as a harp, the brain as full of humming and tremors and making Aeolian harmonies linger with us, not only in the fact of the sympathetic action of Corti's organs, but in the quackery of vibration cures, and allies itself naturally with the tonicity of intermittent muscular discharges. Again, we have the concept of a tissue, plexus, web, woven of complex texture : here, compact and firm ; there, open and gauzy ; or, if this is too intricate, or when fatigue overtakes us, we say the elements are felted or macerated ; and yet again we have a hydraulic system of tubes or channels, deep worn, rutty and with narrow, rapid, or slow and uncertain, or with the currents obstructed. The old idea of images, eidola, copies, patterns, etc., still occasionally helps us out. While the Herbartian mechanics of thoughts rising above a threshold, colliding with or adding momentum to each other, is widely used with analogies from light and heat, reflection, struggle for survival, pressure, stratification and layers, volatilization and inspissation, mirrors, etc., but every article in this well-stocked property room of the psychologist is emasculated and with a kind of limbo reality suspended between merely diagrammatic illustration and the solid ground of histology and physiology, requires an incessant change of mental register, and, if we take it too seriously, it tends to the madhouse. How most of these concept forms can be utilized and confusion obviated, I shall try to show later.

Psychology needs a soul not so much as a *rendezvous* of

An *ideomorph* is the space area containing the somatic activities involved in thinking an idea, and a neuro-*ideomorph* that of the nerve action involved; its *miomorph* is the muscle area concerned. *Boulomorph*, *geusomorph*, *haptomorph*, *chronomorph* and *osphresiomorph* explain themselves. As each sense was thus provided for, I could use *asthesiomorph* for emotional areas; *hormemorph* served for instinct; *nosomorph* for disease, etc. The prefixes established in morbid psychology—*meta-*, *para-*, *hyper-* and *hypo* with *a*, *ana* and *kata*—also were occasionally convenient.

Secondly, the word *dyne* with prefixes, *psycho* and *neuro*, was used to denote the intensity of change within the morphs. If the changes were *cytomorphic*, the energy involved was *cycodynamic*. *Troph*, with the prefixes, designated the supply of nutrient material, not its use. A *trophomorph*, e. g., is the area of increased vascular supply. Finally, a *toxomorph* is the area of deleterious, or of waste matter, due, e. g., to fatigue. All psychomorphs may be thought of or defined by surfaces of *isodynamic* intensity, some one of which marks the threshold of consciousness, below which only neuromorphs of decreasing degrees of *dynism* exist. Practice reduces the dimensions of boulomorphs, while increasing their *dynism*; hesitation does the reverse, etc.

concepts, or a basis of categories, or to make an identity of background, without which thoughts could not be connected; or as an eavesdropping "I think," which Kant said accompanies all processes, but which others believe to be only the creaking of defective mental machinery. It is not satisfied with inner perception, a *sensus communis*, with Czolbe's "sensation of relation," with Lotze's subjective ego, as "the theoretical explanation of somatic self feeling"; nor the Herbartian struggle of psychic elements for self-preservation; nor with any of Bradley's six kinds of self-consciousness; nor with the precipitate nostrification of current conceptions of the social self; nor with the idea of a confederacy of personalities into which the psychic dissection of hypnotism sometimes resolves the human psyche; nor with the gallery of memory pictures illustrating a biography which Hobbs thought made personal identity, and the loss of which Schopenhauer thought was the cause of insanity.

There is now much agreement that all these difficulties admit of practical solution by simply assuming the reality of an ego, more or less autonomous as a regulative hypothesis and going to work, holding perhaps with Froschammer that the mind grows inward, deep, free and unitary just in proportion to the volume of the world process that passes through us to deeds and history. The sensory regions of the brain seem better connected with the motor area than with each other, and find in it the unity they lack in an inactive life. If modern personalities are in growing danger of disaggregation as life becomes sessile and passive, and if the self be as Hirth thinks, merely a biologically useful illusion which really helps us to cement the mosaic of our ego synthesis more firmly, it is at least a platonically "noble lie," and should help us against velities and caprice, absence of life purpose, and kindred practical dangers, beside which the grossest heresies about the ontological nature of selfhood are as insignificant as what might be called the allotropic debates whether the Iliad were really written by Homer, or by another person of the same name.

Indeed, do not the above classifications of children's ideas of the soul, to say nothing of the philosophic propensity to substantiate it in a way that, as the psychic researchers copiously illustrate, tends to apparition theories, show that, just as certain forms of nature worship in children prepare the way for purer religion later, so a dignified and modified epicurean materialism may at a certain early stage of thought be the best basis for soul, immortality, and even God, bad and false as this is as a finality? For the pedagogy of the ego, therefore, this should follow the above discussion of the

crude soul ideas of children and savages. At least this is better than a soulless or epi-phenomenal psychology.

VII. Certain philosophic stirrings often begin very early in life in a more or less automatic reverie of questioning the validity of (a) sense impressions. Many describe in their own early lives or in children they know sudden outbreaks of questioning, whether window, tree, hand, etc., that are being gazed at, are real. "Do you truly see this?" "Is it real, or am I dreaming?" Some objects suddenly seem strange, queer, funny, and children pinch themselves to be sure that they are awake. This experience is most common with vision and rarest with touch and taste, but not uncommon with hearing. "How do I know that objects are not mere appearances?" These experiences seem to originate in some phenomena of sensation, perhaps in some transient functional unhitching from motor or reactionary centres, and this stimulates the questioning, which may extend to the whole of the visible universe. Perhaps the sun, moon, stars, sky, clouds, distant hills are doubted and seem to need some vouchers for their reality. Children look very hard at objects sometimes in an almost dazed way, perhaps open and shut ears, eyes, or both, as if to test the permanence of sensations. When glasses are first worn this primitive scepticism sometimes first makes its appearance, or when things are seen through colored or obscured media. These experiences often occur in spells of reverie or idle contemplation. Juvenile reflection easily extends to spectral doubts about the world or things generally. The soul seems to be herding ghosts or phantoms instead of the wonted realities. These impressions can hardly be explained as hypnagogic, for sometimes the mind is roused at once to the greatest interest and activity by them. It is as if there were a sudden divorce between sense and thought and the visual apparatus became unusually objectified and its deliverances held off at a distance for scrutiny. While the senses act normally they are more reflex and automatic than usual. Perhaps thought or feeling now first declares its independence of sense and now actualizes a deeper reality, more intimate and internal, compared with which objects seem shadowy by contrast. If so, these experiences mark the growth apace of a more spontaneous and vital self, until the world seems a mirage or hallucination for an instant, and perhaps the Berkeleyan argument has this psychologic genesis or point of departure. These dim flitting experiences could not occur without causing, or unless caused by a deeper sense of self.

(b) We must make another although related category for such queries, no less common, as: "Am I real?" "Do I

really live, or am I only make believe, like dolls?" "What am I?" "What is it to be an I?" "What do I do when I think, or what is it in me that feels, talks, etc.?" "What makes my soul and body so different?" "You strike my hands and feet and hurt them, but cannot hurt the real me inside." "Why can I not see myself think when I close my eyes?" "How will my soul look when I am dead?" "What is the me that you cannot see if I close my eyes, or if I hide my head so you can only see my body; or, what is it makes my legs walk?" "What learns my lessons?" "What lasts all night, so I am not changed in the morning?" "Why am I the same that I was as a baby?" "What is it that is sorry, glad, happy in me?" "Why does it hurt me when I cut my finger?" Several describe themselves as pondering over some of these problems by spells, asking their parents without satisfaction, and even becoming tired, frightened and half sick by being preyed upon by such insistent queries. Perhaps this marks the dawn of self-consciousness proper when the ego is first glimpsed or felt after. No returns in our repertory show a trace of Hume's scepticism, but the ego is assumed to be both substantial and actual. Perhaps now new sources of inner energy and spontaneity are opened, and in its new-found independence of self, the soul finds one of Fichte's new potencies. To be able to think, feel and will in emancipation from the thralldom of sense and its reflections, marks the advent of a real psychic freedom that first manifests itself in these crude hieroglyphs of experience. At any rate I am convinced that it is possible to approach the whole problem of epistemology from a new genetic standpoint, and that these experiences suggest it.

(e) Quite distinct from either of the above are the frequent juvenile questionings that suggest the possibility of a very different consciousness or self from that at present existing. "Am I myself, or not?" "What makes me the way I am?" "Why am I not she, or why is he not me?" "If there was no I, would there be another in my place?" Fifty-four returns describe wondering how it would have been if their father, mother, or both, had been different. "If papa had married B, whose girl would I have been?" "Would I have had earls?" "How different would I feel, act, look, or would I be at all?" Children very often suffer for years, perhaps in silence, with the fear that they are adopted and their parents not really theirs, and interpret all that happens about them on this theory, against which no assurances avail. Often they play, sometimes for weeks or months, that they are others, or have other parents. "What name would I have had if C had been my mother?" "Would I have been

in heaven?" "gone there without coming to earth?" or "just not been at all?" Children often go over the list of their friends to see if they would become or change places with them for a time or for good. "Why was I not M (another girl born the same day)?" Some long to get into others' souls to see how it looks there, to get secrets, or to be different. Some imagine themselves someone else, to see if others feel toward us as we do toward them, to escape ennui, or to know how it seems to be colored, etc. They wonder how it would feel to be a tree or rose. Many wish to be flowers, and a bright girl of four believed she was a speaking flower. Imitations and even impersonations of animals are still more frequent. A girl of five, *e. g.*, imitated a horse persistently for days, others will drink like a hen, cat or cow, or insist on sitting on eggs and roosting with the hens, pretending to fly, until they almost fancy they do.

The dramatic passion is almost universal with children. They personate all kinds of people, and imitate even defects. "Let us play we are sisters," said two sisters, as if the fiction gave added charm or perhaps reality to the relation. It seems as if children sometimes hate to have or be a self; felt that personality was not essence but phenomena, and before they attain the virtue of unfolding what is peculiar to self, strove to develop what is common to all the species; feel reluctance to be merely a specimen of a type, and experience a touch of the sublime indifference of nature and of philosophy. A girl of five wrestled sometime with the problem, "Am I not a dog straightened out?" In their plays children even become a post, street-lamp, rock, chair, mirror, table, tree, etc. Only five children state that they long have deliberately wished to become another. A girl of six passionately felt that she could and would not be herself; because it was too dreadful. When angry or forbidden some desire, children often wish they were someone else. Girls frequently wish to be boys, and often expect to be when they are older, or fear they may become boys. Others fear at night that they will wake up someone else in the morning; others suffer greatly for fear that they lack sense, or are idiots, or insane. While special features, qualities, accomplishments, brain, stomach, knowledge, music, gifts, disposition, and still oftener wealth and circumstances of others, are very commonly desired, a great majority are glad they are themselves and would not really be turned into anybody else, especially into certain persons whom they dislike. "I am glad it was papa who found me before anyone else, for they might have changed me." "You wanted a boy, but did not know it was going to be me," said a boy of four. "What was I before I

came into the world?" "Were things the same before I was born, and will they be the same, or will they be at all after I am gone?" "What if I had not been born?" "Where did I come from?" "Why are we in the world, anyhow?" "Will things stay when I am old?" "Who is God, anyhow, and why did He make souls and give us thoughts and watch us use them?"

These phenomena are hard to interpret, but suggest that childhood is generic and full of promise and potency of many kinds of personality and consciousness before the shades of the prison-house close in upon it. There is a trace of pathos if not injustice about separate existence. Individual experience is so partial, so limited—heredity with its vague masses of ancestral reminiscence is vaster than any individual life or mind can express,—and the frequent sense of being exceptional or strange suggests that what we call consciousness is dross or a frothy syllabub, and that there is a larger subliminal existence, a *natura non naturata* of the soul that is doomed to remain a dim region because the light that might illuminate the whole obscurely had to be concentrated in some part, and because personality so involves limitation. The hunger for life may become almost a passion to know what is taking place within other skulls than our own. We desire to be citizens of all times, and of all grades of being and spectators of other souls from the inner standpoint of their own consciousness. The confessional, intimate social converse, knowing and utilizing others' experiences by the questionnaire method, etc., owe part of their charm to the longing for the broadest possible basis of experience and to touch life at every possible point, even if it be vicariously.

(d) Another experience of childhood involves a certain bifurcation of the soul. When they cry many children pity themselves, run to the glass to see how they look, and, even in much agony of grief, waste a great deal of sympathy upon themselves, feel sorry for themselves if they are angry or in pain, sympathize even with their moods, and try to comfort themselves if vexed or gloomy, seeming to stand aloof like another person and feeling sorry for themselves that they suffer. Many stroke and pat themselves, address themselves by pet names as if they were someone else, feeling that pity is their due. Others, particularly girls, when tired or ill, love to fancy themselves growing weak, fading away like a flower, dying young in a flood of self-pathos, bitterly bemoaned by imaginary friends, and are comforted when weeping by observing how red their eyes are and how miserable they look. Others try to help themselves by giving counsel or offering reasons, apostrophizing themselves as

hateful or shameful things; others conceive themselves as made up of good and bad selves, which dispute, argue, and strive for the mastery. Scenes are fancied and even trials at which oneself is judge, before whom the good and bad selves argue the case. "I went where I was forbidden and enjoyed it, but felt it wrong, so there must be two of me." Dialogues and soliloquies, often exciting and in some cases becoming habitual, occur. Especially in the country, children sometimes discuss with themselves nature and their own moods; talk with winds and trees, and imagine answers, mutter dialogues between their own desires and the absent but imagined parents or conscience; and sometimes inflict blows upon themselves if the controversy becomes heated. A few children address their bad desires as Satan; shake themselves, after disobeying, to get him out, etc. Even infants often cry intensely, but peep up to see whether they are carrying their point; cry for effect, and perhaps stop and play happily with ludicrous suddenness if they find themselves alone in the room. Such phenomena as the above are no doubt mainly due to and are among the earlier forms of a social self-consciousness. The real child is the one party, and the will or command of the parent, or the standpoint of the spectator interested or disinterested, is the other. Some of these experiences suggest an almost primitive outcrop of some sort of categorical imperative, if Kant's term is really the proper characterization for conscience in its nascent state; while others suggest one or more imaginary companions. The latter are often only extreme cases of this bifurcation.

(e) Stronger, perhaps, than any of the above tendencies; stronger than the sometimes half insane rage for questioning about God; the remote and infinite in time and space, that make children seem to leave the world and fear that they shall wake up and find there is no earth or anything else; stronger than the backward gropings of the soul toward its own beginning and cause, is the universal protension toward maturity which impels every child in its plays and thoughts to anticipate adult life. Children imagine and imitate "grown-ups" in dress, manner, conversation, select their vocations when infants for the pettiest reasons, until it seems as if the view of Groos was right that most of their games are practice for what must be their adult activities, and that this is the chief business and purpose of childhood. They long to be rag-men, to have nice bells; express-men or conductors, to ride all day; merchants, to have candy; teachers, to mark on the board; milliners, to have pretty hats; plumbers; milkmen; boarding-house keepers, to get rich; a drummer, errand-boy, etc., because some friend is. But on the

other hand the limitations of Groos' theory are painfully apparent in a large class of play activities I shall describe elsewhere, which seem to exercise rudimentary psychic organs and to give them the needed stimulus to vanish before maturity can be attained.

When any sense impression is regarded as such, which occurs most often first in revivals in the absence of the object, the first invagination of an inner self occurs. But for the power of revival shown in spontaneous recollections, self-consciousness in the epistemological sense would either not arise or be long deferred. This occurs in the various sense spheres, in each of which residua of past sensations accumulate in stock, and are arranged like to like by agencies related to those which which Maxwell called "sorting demons." We are already on the way from Locke's first to the second of his two sources of all knowledge, from sensation to reflection. This involutive process works at each sense-centre, and will slowly carve the inner self out from the body as the childish experience above described delimitated the skin-bounded body from the world of impression in which it was first imbedded. About every efferent centre motor images are also accumulated. At first inner perception is a dim realm of shades, but the shades gradually take on reality, form, color, motion, and may be mistaken for sensations themselves. This introverted, gastrula-like stage of thought is often marked by what seems to stupid and morally bigoted parents and teachers, lies. "I saw a thousand bears and tigers in our yard," means a sense image of a number of these animals springing up in my mind clearly and for the first time without any corresponding objects, while it begins to dawn upon the child that he carries possible menageries in his imagination and is getting independent of sense. Perhaps, too, in the embarrassment of being overheard talking to himself, he learns the difference between speaking and thinking, and divests his psychic processes of other muscular forms of expression, and learns to think acts it cannot do, for repression excites subjectivity. These lies of sense and of achievement are a quite distinct stage of mental evolution to which we shall recur, because the power to play and work with these seems to mark the line between the animal and the human psyche. The outer is known through the inner, there is a perception of the products of former perceptions. The child no longer gives himself fully and with entire abandonment to the objective world, but begins to draw back a little even from his own body, which ceases to be a part, or at least the whole, of himself.

As thus self-consciousness slowly arises by involution from

object-consciousness, and apperception from perceptions, instead of lingering in the lower regions of sense images the noetic passion may strive for a knowledge of knowledge raised to some higher potency, and be drawn towards the vortex of the mysterious but fatal involucrum of solipsism, which, to change the figure, is like an encystment, from which the soul has no palingenesis. No matter how many rival ways of escape from agnosticism may be patented, just in proportion as the world comes to seem only my concept will every volitional or emotional reaction upon it seem unreal. In speculative, as in morbid psychology, delusions of greatness go with progressive paralysis. Fichte's familiar but unique and matchless romanticizing with the idea of self by anthropomorphizing the universe into an absolute cosmic ego, whose essence it is to posit itself as being, whose "I am" is the only possible deed or act, to which all objectivity is only its own reduced activity, and which is to be annihilated and destroyed by moral reaffirmation, may slightly inebriate the sanest of us, but we must not yield to the fatal *ubris* of Titanism, and try to inflate our puny egos to God-likeness of this kind. Presentation, representation, re-representation, etc., however far continued, and on however many superposed Jacksonian levels which the future may make possible, and to whatever high potential knowledge may thereby be raised, can have no other possible meaning than a practical one. We are not forcing the ego back to its lair, stripping off its more outer and then more inner garments with any possibility that it will ever thus, as Tertullian prayed, stand forth at last, naked, pure, free, a precious kernel, fully shelled out of its last husk. To assume any identity between subject and object, as Schelling did, or even an Hegelian equipollence, is to belie the very nature of the fiery particle within us, which, as if it were the culmination of the *biologos* itself, is not expressed in any of even all of the forms it has made; but whose essence it is to create, and which is the only *actus purus*. By its spontaneity the attention presses in from point to point, and what it has been and done is only the prelude to what is to come. Whether it will ever entirely eject or objectify itself in some far-off apokatastasis, whatever such a state may have meant to the mystics who have reveled in its description, seems extremely improbable, because, in nature's economy consciousness is always either remedial or directive, and the automatic is always closing in upon it. The idea of a centre or a state of all consciousness, as we understand that most polymorphic of all terms, whether of a being who simultaneously knows all, and directs all details of the universe as steps in accomplishing a maturely deliberated policy, or of

monadic souls, each *parvus in suo genere dens*, reflecting the entire universe, is a dream of lotus eaters, a fool's paradise, for it immolates nature, whether human or divine, to intellect. In fine, introspection can never solve the problem of the self.

VIII. The influence of other selves upon our own self begins in the mysteries of heredity and takes a more objective form in gestation. Whether the mother's movements are tranquil or sudden and violent is registered upon the body and soul of the new life she carries, as the planchette records every change in the tension of arm muscles; she who does most for herself does best by her unborn child. When after birth her movements act no longer through a fluid medium, her touches, pats, caresses, the act of nursing, etc., make for some time a large part of the child's outer world of change. Perhaps as probable a beginning as any for the social consciousness of the child is its first recognition of its mother's face, which occurs during the first few weeks of life, and which many of our returns emphasize as an event of great distinctness and importance, as did Froebel. The child is born with the power to cry with great vigor, but the power to laugh comes very gradually and later, and it is often this recognition that causes the first smile, and may excite it to writhe all over with joy. It is easy either to speculate or poetize about this event. Before, perhaps, the child is solitary, alone in the universe, so far as its own rudimentary consciousness is concerned; but now the first "thou" looms vaguely up in the void. Possibly, too, this moment is the natal hour of the world of objects, of all of which its mother's face is the "promise and potency," and from this as a starting *point de repère* the child's mind slowly delineates impressions of other selves, if not things, etc. At any rate, it is the eye that chiefly fascinates, and, although a stranger might have been detected before, especially by touch, this eye and face at least are now known to sight. Sympathy is now born, love has its object, the recognition involved marks the first conscious memory as an act of joy of a new and unique kind. Starting from the face and breast the mother's body is slowly defined, although her eyes and, perhaps, mouth, hair, etc., are noted first; the child notices its own hands, feet and ears before it does those of its mother's, and also becomes aware of its own internal organs and processes first, and the instinctive comparison part by part above described defines its first somatic "other" as well as its first somatic self.

Meanwhile the child is subject to many manipulations by the mother. Her face is associated with a vast variety of touches, sounds and movements that make her the source of a great part of all the changes possible in the infant's psychic

horizon. She causes it to pass from hunger to satiety ; from cold and wet to warm and dry; from one attitude and position to another ; her presence means every possible pleasure, and her absence every possible pain. The sense of being alone even for an instant is the desolation and horror of the abyss. She is the child's Providence, on which it is absolutely dependent to a degree that few of the most religious men ever really conceive themselves to be on God. If she fails to make herself thus the bright focus in the child's nascent social consciousness and be all a good mother can and should be, the child's own personality will be less organized and unified and will have less power to reverence the divine personality at the heart of the universe whose place she is shaping in the soul by her own, almost as the wooden model makes the matrix in which the iron will later be cast. She, for a time, embodies its entire world of others, divine or human. She is society, and from her all other persons are learned and differentiated. They, too, dawn upon the infant's mind as she did, eyes and face first, suggesting platonic or cherubic heads, and are slowly defined in body and act as she was.

Again, in all its good moods the child's rapport with its mother dominates its conduct. It early comes to do all she smiles at and to avoid all else, as if its only vocation were to divine and follow all the lines of her likes and wishes. Its nature expands not only toward, but in proportion to the sunshine of her favor. It respects all she smiles at, even buffoonery ; looks up in its play to call notice and study the currents of her sympathy. If she is happy when the child is good and slightly saddened at wrong, the normal child will choose the right as surely as pleasure increases vitality. It cannot act on her fear and should not on her resentment, but it can act on her love, and if that is strong and deep, obedience, before language can be much understood, will be an instinct. The mother, too, is the child's first pattern and exemplar, and sets the copies for a mass of imitation, conscious and unconscious. Her rhythms in motion, accent and inflexion are a contagion. As she is quiet, poised, reposeful or excitable, spasmodic, irritable and nervous, so is the child. If she is happy, euphorious, contented or sour, full of symptoms and aches, discontent or anxiety, each of these moods is reflected in the child. All these and a host of other influences emanating from the mother are registered in the basal strata of habits in the nutritive and motor systems, in rhythms of rest and fatigue, etc., that are not only unchangeable themselves, but condition all later superstructures.

But as a new planet is gradually thrown off a central sun

and slowly spheres itself and finds an orbit and then develops forms of life all its own, so the infant soul develops slowly to independence; but as the planet was made from the matter of the sun and never escapes gravity, so the soul never can escape what the mother was and did to it. The infantile charm of bo-peep plays with impressions of momentary existence without her. The timidity, fatigue or health of infants at a certain stage we may conceive to vary inversely as the square of the distance at which they can be left, carried, creep or walk from the mother before the inevitable sense of solitude or fear of getting lost overwhelms them. Other members of the household become too slowly increasingly prominent factors in the development of the child's social consciousness. For country children the interval between the family and others is more marked than in the city; for the former in their earliest years and also the family have more definiteness and also stronger attractions.

Soon two tendencies develop: one centripetal, inclining the child to its own home of which the mother is the heart, and the other centrifugal. Homesickness and the passion for other scenes and faces, illustrated, *e. g.*, in *Trnancy* and the migrating instinct, often struggle with each other. Some children wander away, launching out into the big world, and leaving all behind them without fear or regret, while others show an equally abnormal dread of getting away from familiar faces. Owing perhaps to some reverberations of the ancient war of all against all in the long and bitter struggle for existence, all strangers, especially those with too unusual dress, features, acts, etc., are at some stage more or less feared, although with great difference of duration and intensity in different children. A peripheral limit of the expansive social tendency which radiates from the mother outward is marked for most children by deformed or colored people, policemen, soldiers, tramps, the doctor, coal-man, rag-man, etc., whom they fear. Between the too familiar and the all too strange and dreadful lies the wide field where the expansive social tendencies as love, slowly widening to include mankind, nature as a vast repository of personification, and curiosity which would see, feel and know all, meet and mingle with the deeper counter-currents of ancestral dread, and make strange eddies and whirlpools in the brain cell, nerves and pulses as well as in the soul. In some children the latter predominate and they are so embarrassed, shy and timid that they can do nothing before strangers without awkwardness and mental confusion. The attention of friends to the acts or persons of such children is the kinetic equivalent of the presence of strangers in its power to overstimulate inhibitions or to

excite bashfulness; to be looked at is as paralyzing as to be placed before an audience. "Don't let anyone look at me," is a frequent request when something is to be done and a steady gaze may not be the "evil eye," or have power when directed to the back of the head to cause one to turn around according to current superstition, but arouses painful self-consciousness or anger in children, and is often construed as an insult by adults. Others love to be in the focus of attention and do anything to attract and hold it; are stimulated by it to all sorts of "showing off," and are spoiled by flattery, and dull without it. The passion to be interesting and to compel others to like them may make children bold, vain, affected like George Eliot, who at the age of four would pound the piano with many airs if anyone called, or to make the servants think she was a great musician, yet this indicates great social sense and capacity. Such children are likely to lose the proper balance between love and fear which gives the psychic tension called from its various degrees and forms bashfulness, modesty, respect, reverence, docility, etc., all of which are manifestations of fear toned down, and variously tempered and alloyed. The very acme of social zest is where some expansive impulse has just won some new victory over fear, and the stranger, the bully, teacher, etc., treated with some new familiarity, the person with decided or superior manners, the critic or enemy faeed. There may be flushes, tremors, or even conflicts, but the self grows with every such courageous affirmation.¹

¹ Professor J. M. Baldwin ("Mental Development, Social and Ethical Interpretations," p. 195 *et seq.*) thinks there are three stages of bashfulness: first, a primary, organic kind in the first year toward strangers; second, an opposite tendency to tolerate strangers and like persons generally, due to kind treatment; and third, a return of bashfulness in the second and third years. The second stage is said to have its phylogenetic parallel "in the rest man took after his release from the animal." This second stage of loss of fear, the author sees illustrated in the life of the Hebrew patriarchs, etc., and discusses whether such a period occurred "over the whole earth at once," calls it in a note a "well recognized period," but says that to confirm it would require much research he cannot bring, and hopes that his declaration of the hypothetical character of the parallel will appease the "learned critic whose red-rag instinct is keen for theory."

I can not find, nor can several anthropologists I have consulted, any trace of any such "well recognized period," nor anyone who ever thought that it existed "over the whole earth at once." Indeed there are many reasons why such a stage must have been both geographically and ethnographically limited in extent and brief in duration. Again, it is not the infant of one or even two years that would reflect the race stage described, did such stage or its reflection exist, but the boy several years older. Once more a careful scrutiny of returns based upon several hundred children I have col-

There are many influences in modern life that make for psychic disintegration, and tend to reduce our individuality back to a polyzoic aggregate of cells and unshepherded states. For many, life is sessile and receptive, whereas unity is a product of actions. Mere knowing disaggregates if divorced from practical life. There is, too, such a multiplicity of cultures and theories. The views concerning the ego would not, perhaps, equal in number the 289 theories on the nature of the highest good reported by Varo, but their conflict alone makes it impossible to lead what Aristotle called the purely theoretic life of reason. Mixture of blood and heredity causes the ununified, if not contradictory, traits found in mongrel races. Imperfect health causes fluctuations of mood and those alterations of somatic feelings which not only lay the basis of parasitic personalities, but may of themselves alone cause mental perversion and even alienation. The weaker the body, the more it comes to the front and commands; the stronger it is, the more it obeys and the less it appears in consciousness. Over-culture, so common now for feeble souls, both distracts and weakens. Too many or too alien ideas forced upon an unwilling intelligence are not marriage of the soul to knowledge, but rape, the analogies of the results of which could be traced out at great length. This makes real love of knowledge impossible, but may cause a meretricious itch for dabbling with great subjects. The history of philosophy teaches such minds merely to hold no opinions. The rage for examination and explanation prevents real acquisition, which is automatic, and acts not unlike an emetic in interfering with mental digestion. Too many companions of

lected, show no trace of Professor Baldwin's second stage of reduced fearlessness or bashfulness between two augmentations of it, but only a very steady reduction and change of base through all the early years of childhood.

Indeed, while believing the careful and prolonged studies of single children is one of the very best lines of work, and has given us some of our best data, I think that a mono- or diopaidic basis is not broad enough for *speculative interpretation* of such wide range. At least to estimate a work "drawn largely from direct observation of children," the value of which Professor Baldwin well says "consists in the possibility of their repeated corroboration," we should be told how many if not what children were studied, or at least what method was used to reach such general results. If, however, it is simply "the child" or the "concept of childhood" that here is analyzed, this method, too, has probably its place despite its peculiar dangers, but it is more that of the Baconian spider that evolves from within than of the ant that merely collects. Granting, however, both to have their place in the economy of nature, we hope both spider and ant may live to see the bee that both collects and evolves, enter the broad, new field of child study, which is now but a promising acreage of buds, and to taste her sweets.

the same, or of too many different sorts, city life, much society, and indeed civilization generally, is not favorable for the quiet, inner, Rousseau-like growth of country life near to nature. Too many toys, interests, studies, friends, dresses, pleasures, moods, and even too frequent resolutions of radical reform, are dissolutive.

On the other hand, an education that fits native interests, evokes will, has a natural instead of an artificial and programme-made unity; some occasional obstinacy and self-assertion, that contend for supremacy with other egos; the keeping of a personal conscience, a sense of duty and honor, and knowing how it feels to follow these against the mob; friends and interests, that the flavor of conviction be not utterly lost; some few, deep beliefs we could die for, even though the creed be not formulated; fixed and regular habits; vigorous thinking that has wondrous power to bring unity to the loosely cohering elements of our mental life; a life sphere that fits our ability and taste and that has not too many galling points of friction; a broadly based specialization that gives us a certain mastery in some small point, and is a refuge of the soul in which it finds compensation for many inferiorities; enough property to give an independent self-respect, but not enough to make us in any sense its slave; just pride of country, home, family, and having a character and reputation in the community that are what we deserve and have distinct and marked individual features about them; the bearing of responsibilities;—these cement and strengthen the ego synthesis.

A person is a vast aggregate of qualities and influences vineulated together, treated and acting as a unit. After Cicero many ancient and mediaeval works on oratory listed the traits of an ideal *socius*, best calculated to influence men, and most worthy of respect, or most provocative of imitation. First was form, figure, complexion, and the factors of physical beauty, fine eyes, nose, chin, bust, foot, hand, shoulders, etc., the contour of anyone of which might have a perfection that was ravishing, and if truly put in marble would make a sculptor immortal. Physical beauty is an immense power, and ugliness is an eternal disadvantage. Next come dress and toilet, with every detail of hair, nails, shoes, head-gear, proper fashions, and even cosmetics, perfumery, etc., if and where needed, correct taste which is the beginning of art and which remedies defects of form, all of which are subjects worthy of long and detailed study as sources of proper personal influence. Third come the automatisms, which are among the most important media of likes and dislikes, and even fetishisms, tricks of articulation, of facial

expression, bearing and carriage, the use of the voice, positions and movements of hands and feet, smiling and laughing, habits of fan, handkerchief, napkin, knife and fork, gesture, inflection, all the minor morals of manners, the magnetic aura, atmosphere, presence, style, which reflect all one's environment, breeding and heredity, and which because they are unconscious reveal the true self that words, social forms and conventionalities so often hide. Then come the voluntary actions, either deeds accomplished or abilities which mark the range of the ego of will. What can one do? How would he act under the strain of jealousy, anger, love, fear, temptation, and in any possible condition? What is the vocational sphere of action? where would character give way? self-control be lost? and how much energy is there? Fifth, what are the quality and flux of the habitual currents of feeling? the temperament and dominant sentiments? Is there the hearty euphoria of that good fellowship which covers a multitude of sins? the good heart that is Prince Hal's "sun and moon"? Does duty rule? or is the soul weakened by self-indulgence? Is it malevolent? tricky? hypercritical? How will it stand the strain of disappointment or affection? of publicity? fame? fatigue? Is it stable or moody? harmonious or unbalanced? sickly? self-conscious and morbid? or hearty? eupptic? or eueholic? Then, and far less prominent than we think, come the mental equipment or intellectual possessions of culture, the size of the fund of knowledge, the inventory of mental resources, and especially the breadth and height of sympathies, both for persons and ideas, the range of interests, the judgment and sense in the use of knowledge, originality, and independence of thought. If to these we add the still more adventitious advantages of fame, wealth, birth and name, we shall have a magazine of influences which has a power to hold other souls up together and to keep them occupied and well directed, the vast and manifold beneficence of which psychology is still unable to trace.

Such and other highest human qualities united in parent, teacher, friend, preacher, professor, doctor, hero, ideal or super man, who can let all his faculties go and yet be only and purely good, are far more unifying for the souls of those within their sphere of influence than institutions, social traditions, or mere impersonal and unembodied instruction. The Homeric world had no state, church, school; no Bible, literature, science, or inventions; but all was solvent in personalities, and in the natural relation between men. It, and not the mobs of degenerates, is the true expression of man's gregarious nature, and hence its marvelous fit to the estate of

youth which is moulded by contact with great characters, and, if it does not find needed heroes and leaders, makes them often of the poorest material, or finds tinsel idols in the cheapest fiction. These, with enough errors and sinners to exercise the instinct of "universal opposition," which in due season and degree is so essential an ingredient of character, constitute the fundamental features in the environment needed to develop well compacted personalities.

When we are told that nothing but the soul can mirror itself, that self-consciousness is the Bible of the psychologist, I reply that only a part of the soul is therein revealed; that personality has far deeper roots in unconsciousness; that the testimony of consciousness, wherein only a part of the soul content knows another part, can not express the most important elements; that all the processes in it are land-locked, as in an inland sea, far from the great ocean of life and mind, because thought must at best imitate sense, however dimly and remotely, and that consciousness is "not the creator or bearer of the ego-synthesis, but only one form of its expression." Even if we had a complete history of the consciousness of every member of the race, it would be a very incomplete expression of the human soul, not only because consciousness is yet in its babyhood, and the best things are not revealed in it yet, but because from its very nature they never can be. We have sought the real ego in the intellect. It is not there, nor yet in the will, which is a far better expression of it than thought. Its nucleus is below the threshold of consciousness. The mistake of ego-theorists is akin to that of those who thought icebergs were best studied from above the surface and were moved by winds, when in fact about nine-tenths of their mass is submerged, and they follow the deeper and more constant oceanic currents, often in the teeth of gales, vitiating all the old aerodynamic equations.

We must, therefore, without neglecting these older oracles, turn to a different source for real knowledge of the real self, viz.: the objective study of every phase and every growing stage of the psyche and of the soma in animals, savages, and children. Soul is vastly larger than consciousness, and the highest powers are those that spring from roots that start deepest down in the scale of life. Consciousness is as different from mind as froth is from beer, and the syllabub of some of its exploiters and "promotors" suggests the mediæval barber's apprenticeship, which ended when the tyro could make two tierces of foam from two ouñces of soap. Perhaps the excuse of some philosophic apprentices, were it as naïve, would not be unlike that of the Boston tapster, who, when

remonstrated with by his customers for selling so little beer and so much froth, replied that the better the beer the more it foamed, and also that the profit was in the froth.

Hence child study, because of these limitations of introspection, and even of consciousness, and because the real deeper self can confessedly never be thus known, turns to more purely objective methods. It is a homely term, and psychogenesis, paidology, or some others might have been more academic, but it represents a movement so fundamental that it was necessary to appeal to the larger constituency of virgin minds, who knew none of the prejudices so inveterate in philosophic schools and sects, and to utilize the deep instinct of parental love which has created all education systems and institutions. In doing this education and philosophy have both gone back to re-examine the foundations from which they sprang; have turned to first principles and to plain common sense as the ultimate court of appeal, and sought to reaffirm the practical obligations of these studies and to meet some of the crying needs for a philosophy that shall do for our land and age what the great philosophers of other periods have done for theirs. Recha was rescued from a fire by a stranger in white who vanished, and her gratitude idealized her saviour till she thought she owed her life to an angel, and her mystic, contemplative mind elaborated a cult of worship which gradually absorbed her life almost to the point of mental alienation, when suddenly came the announcement that a man, A. B., who had snatched her from the flame, was dying for a woman's ministration. Her illusions vanished, and she found sanity, and he was restored by her to life, and a career of philanthropy. Philosophy was to Plato a quest of eternal foundations, when a decaying state and a sophistic culture seemed to threaten general dissolution. Later it wrought old cults to unity and opened the way for Christianity, and still later gave it an organ. It gave science its methods and instruments, unified the Teutonic spirit, and expressed the English induction and utilitarianism, and in this country it laid down the methods of church, state, school and college. Latterly, however, we have been almost playing with philosophy and fascinated by not only unfruitful but unsolvable problems, have striven to be critical and polemic, brilliant and literary, gone astray in technicalities and details, revived problems once vital, but now dead, because no longer practical in the high moral sense; rendered a rather doubtful and uncertain service to religion and plain right living, and above all hypostatized to theoretical regions the agencies that were meant to save men from passion, fill them with enthusiasm for the ideal, purge their souls from faction,

jealousy, superstition and selfishness, and bring consecration to the vocation of leading lives devoted to the highest service. With regard to the self, indeed we have lapsed almost to the standpoint of Condillac, who said: "When I smell a rose, *e.g.*, this sensation of smell is my entire ego." Teachers of philosophy, now called, like Recha, to more serviceable work, are responding as she did, and the results already seen are a new sense of the need of these chairs, despite the many rival claimants for scholastic time and money, the better ministration to troubled adolescent needs, the decline of epistemological and simply historical, and the increase of neurological and ethical teaching, the aid to impending religious and social transformation, and the better development of children and youth to the fullest maturity of mind and body. This is the best and highest test of home, school, church, state and civilization itself, and the basis of the only true philosophy, not only of education, but of history.¹

¹Although I have had help from many others in response to the questionnaires upon this topic, I desire to express my special indebtedness to the data collected by Miss Lillie A. Williams of Trenton, N. J., and Miss Sara E. Wiltse of Boston.

PSYCHOLOGICAL LITERATURE.

(67) *Raumaesthetik und geometrisch-optische Täuschungen*. Von THEODOR LIPPS. Mit 183 Figuren und Einer Tafel. Schriften der Gesellschaft für psychologische Forschung; Heft 9 u. 10, 2te Sammlung. Leipzig: Verlag von J. A. Barth, 1897, pp. viii, 424.

Die geometrisch-optischen Täuschungen. Von WILHELM WUNDT. Des xxiv. Bandes der Abh. der math.-phys. Classe der kgl. sachs. Ges. der Wiss. no. 2. Mit 65 Textfiguren. Leipzig, B. G. Teubner, 1798, pp. 126.

In the *Beiträge zur Psychologie und Physiologie der Sinnesorgane*, the *Festschrift* prepared for Helmholtz' seventieth birthday (1891), Professor Lipps published a long paper (93 pages), entitled *Aesthetische Faktoren der Raumanschauung*. This paper should be studied before the reader ventures upon the book now before us; it gives an abstract and brief chronicle of the author's aesthetic theory, and of his view of the relation of the aesthetic problem to the problem of the geometrical optical illusions. Again, in the *Zeitschr. f. Psych. und Phys. der Sinnesorgane*, Bd. xii, Heft 1, is a preliminary communication upon the latter question, headed *Die geometrisch-optischen Täuschungen*. This should be read alongside of the book, as furnishing a conspectus of the author's treatment in the larger work.¹

The fundamental idea of all these publications is that "the optical and the aesthetic impressions that a geometrical form makes upon us are merely two sides of one and the same thing, having their common root in ideas of mechanical activities." Every space formation, all formed space, is the seat or vehicle of living force; it strives or tends to rise or expand, it resists, yields, moves, runs out, etc., etc. In a word, it shows us the manner of its origin, the natural reason why it takes on just this form,—always, of course, after the analogy of our own human activity; and its aesthetic consideration is simply the translation of its presence or bare existence into this activity. As human action is directed upon some end, so is the activity in the space form: the principle of aesthetic freedom includes the free determination and the free realization of an end. Geometrical forms are ugly only (and always) when the force or life that is in them cannot work itself out, or is compelled to serve the wrong end, to play an ill-fitting rôle. (Pp. 1-26.)

The 'naturalness' of a form, however, has its mechanical side. The 'free realization of an end' is at the same time mechanical uniformity, obedience to mechanical law. Not the mechanically regular form is beautiful, but the form which shows the free working out of a definite mechanical movement. Past experiences have given us a direct, not consciously mediated, 'feeling' for mechanical possibility; we 'feel' that in a particular figure the movement is assured, easy, effortless, while in another it is uncertain, unstable, forced. Putting this together with the result reached in the pre-

¹A good discussion of the whole topic of geometrical-optical illusions will be found in ch. vii of Professor Sanford's "Laboratory Course."

ceeding paragraph, we arrive at the principle of 'æsthetical-mechanical unity.' The column or the wave line is æsthetic: imagination reads human activity into it; it is mechanically right, the expression of mechanical uniformity; and it is, further, unity—the action of a personality, the working out of one mechanical force, given once and for all. (Pp. 26-41.)

The unity of 'becoming' or of self-production which the space form evinces, which in virtue of its æsthetical-mechanical interpretation in our feeling it must evince, may be of various kinds. We can distinguish successive from simultaneous unity, the unity of the column from the unity of the group or cluster of columns. The former we may call quantitative or singular unity; the latter, qualitative unity with quantitative differentiation. In the third place stands antagonistic or central unity, that of opposed activities arising from a common source. Prototype of (1) is the human volition directed upon a single point; prototype of (2), a human activity rooted in a single, qualitatively identical volition, but embracing a manifold as its object; prototype of (3), the volition that aims singly, with opposition of direction (stretching out the arms, e. g.). The relation of this theory to the doctrine of 'multiplicity in unity' is obvious. It only needs to be added that the unity of opposition implies the principle of equilibrium. (Pp. 42-50.)

The principle of equilibrium is wanted, however, in a wider sense. Every space form shows the balance of activity and counter-tendency. There would be no activity in a form at all, were not the form constantly threatened by, obliged to maintain itself against, the counter-activity. Nevertheless, in every concrete case, it is one of these activities that is, for our idea, the primary or 'real' activity of the form, while the antagonistic activity appears as a merely secondary tendency. The terms are, naturally, correlative. Thus, if we oppose the limiting activity of boundary lines to the expansive activity of the enclosed space, it is clear that limitation is the primary activity, expansion the secondary counter-tendency. Again, in the vertical figure which is conditioned (positively or negatively) by gravity, it is the activity of expansion or extension that is primary, the counter-activity or tendency that is secondary. And thirdly, in the case of direction of movement, the diverting activity is primary, the tendency to continuation in a straight line secondary. These three antagonisms are of prime importance for the theory of optical illusions, to which we now pass. (Pp. 50-60.)

These illusions arise as we ideate the forces of space forms, i. e., let them work themselves out in our idea. We perceive a form; we have an idea of the activity producing it; this implies the idea of the working out of the activity; this idea is superimposed on the perception,—the activity works itself out; and the illusion is there. Note, then, that the illusion is not due to perception, but to deception of judgment; we compare perceptions under circumstances in which modifying ideas force themselves upon us, and the judgment of comparison is itself modified in the direction of these ideas. In other words: we superpose, in comparing, the modified memory-image of the one perception upon the other perception-image. The concomitant, modifying ideas are 'unconscious.' (Pp. 61-69, 203, 339, 368, viii, etc.) The reader will now understand how it is that the first sketch of Professor Lipps' theory appeared in the Helmholtz *Festschrift*.

Although the detailed exposition of the rest of the book adopts a classification by geometrical form, in place of that by the threefold antagonism of activity and counter-tendency mentioned above, the first section deals with the illusions of expansion and limitation

(pp. 70-140). We set out with the general rule, whose deduction is evident, that limited space magnitudes are as such underestimated. But the boundaries of a form may be 'mere' boundaries, or may themselves, *e. g.*, be 'forms.' So we get the rule of the 'concurrency' of interpretative ideas, and the distinction of 'grades' of limitation. If counter-boundaries differ in grade, illusions necessarily follow. Vertical extension is overestimated as compared with horizontal, since it is doubly extended: from below upwards by the force opposing gravity, from above downwards by gravity itself,—both primary activities. Exceptions must occur, under certain circumstances: when, *e. g.*, the concurrency of horizontal and vertical is replaced in idea by some other play of forces (circle), or when the vertical is subordinate in idea to the horizontal expansion (torus). Further: we may distinguish 'degree' of limitation from grade of limitation. Increase the bounding power of a boundary by making a figure smaller than it was, and you increase the grade of limitation, in arithmetical progression. But you do more: you increase the degree of limitation. For increase of limiting activity means increase of the counter-tendency, the expansion, or resistance to limitation; your boundary bounds, therefore, in higher degree, at a higher stage of limitation than it did before. And the reduction of the counter-tendency takes place in geometrical progression. Here, again, is occasion for illusion and modification of illusion. Besides, the question arises: when are we to regard the smaller figure as identical with the larger, *i. e.*, as the vehicle of an equal expansive tendency, and when are we to suppose that its initial expansive tendency was less? So we are led to the illusions of confluxion (linear) and contrast (superficial). Both depend upon identification, upon the adoption of the identity point of view (law of simultaneous unity).

The following section (pp. 141-256) discusses, with great minuteness, the illusions of division and composition. Here the reading becomes difficult. Indeed, the work as a whole is the reverse of easy. The reader should be warned never to pass over a back-reference, and never to attempt the book unless he has pen and ruler and compasses at his elbow. In ch. 29 of this section (varying magnitudes of the parts) he will do well to draw a rough system of curves, for guidance in future chapters. Very careful study is required, if justice is to be done to the author's reasoning.

We set out with primary conditions of illusion. Let us look at the whole: then the part, as part, has only that tendency to expansion which is peculiar to the whole in all its parts; the part is underestimated. Contrariwise, let us look at the part: then the part is not simply part, but also itself extension; the divided whole is overestimated. Over against these stand the secondary conditions. The part, as filling out the whole, as extending within it, should be overestimated; the divided whole, the space within which the parts bound each other independently, should be underestimated. The appeal is to experience; and experience defines the mutual relations of the conditions as follows: reference of the limits of the whole to the part means underestimation of the part; reference of the part to the limits of the whole means its overestimation. The greater the part in relation to the whole, the more is the part over, the whole underestimated; the smaller the part, the more is it under, the whole overestimated. True, this is merely a rough statement. The quality of the part, its qualitative relation to the whole in which it stands, affects the illusions. And in estimating the influence of the varying size of the parts we have to distinguish a quantitative factor in the apparent shortening of the whole (*i. e.*,

the quantum of tendency to expansion that is held in equilibrium by the limits of the part) from a 'gradual' factor (the grade of the limiting activity): their interplay gives three maxima and two minima of apparent length. Instances are the symmetrically tri-sected point distance, and the smaller circle placed concentrically within a larger. Quality again has its effect. But in making distinctions of quality within the parts of a whole we have traveled beyond the illusions of division proper; we can pass to those arising from the connection of distances (or lines) with surfaces. These lead us still further, by way of distances embraced between triangles, to the illusions set up by the coincidence of activities (1) whose directions are opposed, and (2) whose directions are relatively the same.

Here belongs the famous 'optical paradox,' the 'arrow-head and feather illusion,' the 'illusion of Müller-Lyer.' We may give Professor Lipps' account of it as an instance of his general treatment. Why do we overestimate the length of the horizontal line that lies between diverging end-pieces? The answer is this: "The terminal points of the line limit it, and limit also the oblique pieces. This second limiting activity works upwards and downwards, in so far as the oblique pieces trend upwards and downwards. It works outwards, in the horizontal direction, in so far as the oblique pieces trend outwards. Just in so far as this is the case must the limiting activity of the terminal points towards the inside, towards the horizontal line itself, be canceled by their limiting activity outwards, towards the oblique pieces. To the same degree, of course, the limiting activity of the points towards the oblique pieces is canceled by their activity on the side of the horizontal line. That is to say: the length of all these lines is overestimated." It follows that the illusion increases, within certain limits, with approximation of the oblique pieces to the horizontal; and that it decreases with increasing length of these pieces. Why, on the other hand, do we underestimate the length of the horizontal line that lies between converging end-pieces? "The limiting activity which the common terminal point exerts upon the horizontal line, and the limiting activities, relatively of the same direction, which it exerts upon the oblique pieces, reinforce one another." The illusion is less than in the former case, because the tension (produced as reaction by the increase of the limiting activity) is greater. The effect of the relative obliquity of the end-pieces is the same; that of their length naturally the precise opposite.

We come, in the third place, to the illusions of direction (pp. 257-320). They may arise under three conditions: when the differently directed forms or form elements are given contiguous; when change of direction occurs during the course of a single movement; when the different directions, though independent of one another, are spatially coincident. The vertical and (to a less degree) the horizontal directions are in every instance 'principal' directions. As the modifying activity is in all these cases the primary, there is a constant tendency to the overestimation of differences of direction. (The relation of this rule to the current theory of angular estimation is plain.) The principle that dominates the section is the principle of the 'mechanically unitary apprehension of directions'; and its rule runs: "If, in consequence of the conditions under which it takes place, a movement divides for our idea into various components, then in every case (or in every phase of the movement) that component is overestimated which in general (or in the particular phase) is most 'drawn upon,' or whose realization seems to be most energetically demanded, for the result be-

fore us." The rule evidently covers cases of apparent approximation as well as cases of apparent divergence of directions.

The final section (pp. 321-419) treats of variations of contour (superficial boundary). These take us back to the 'identification' question of the first section. Let the surfaces stand independently side by side; then we give them in idea an expansive tendency that fits their actual magnitude. Here come the illusions dependent on interaction of height and breadth. Let them now form parts of a single, differentiated whole: then we give them, despite their different size, one and the same expansive tendency. Here come the illusions of (rectangular) projection and retraction. From these we pass to those of reduction or tapering, taken first alone, then in connection with opposition of direction (where we are brought to the optical paradox again), and lastly in connection with axial activity. Reduction passes over, in its extreme form, to the point or gable. Finally, leaving right lines, the author discusses the effect of continuous curvature of the boundary, taking as his illustrations the scotia and the torus, the concave and the convex departure from the vertical.

In an epilogue Professor Lipps emphasizes the threefold result of his inquiry. He has, in principle, settled the question of optical illusion. Secondly,—and this is more important,—he has contributed to the establishment of an 'aesthetic mechanics,' to our aesthetic comprehension of the geometrical forms employed by the arts. And thirdly, he has illustrated the delicacy and uniformity of the psychological working of 'unconscious ideas.'

Of the aesthetic part of the work I have, in the above hasty sketch of its contents, said very little. In reality, there are aesthetic 'additions' at every pause in the march of the argument. As, however, the writer's whole aesthetic theory, the theory of 'mechanical anthropomorphism' or of 'anthropomorphic mechanics,' the harmony of the free activity of the human personality with the uniformities of mechanical forces, is given in the introduction,—and as the 'additions' merely carry out the general point of view in detail, showing where the optical illusion is a protest against the aesthetically (because mechanically) impossible, etc.,—it seems unnecessary to devote space to it here. Nevertheless, I believe that the aesthetic theory is, relatively, the strongest thing in the book, and, absolutely, a theory of the very highest scientific value.¹ Indeed, the aesthetic atmosphere is over all: the book at large, if we regard chs. 29-36 as an excursus (p. viii), is aesthetically planned and proportioned. Starting out from the Doric column, we find at the end of our reading that we have been taken through the Doric and Ionic orders, stylobate, column, entablature and pediment, step by step, illusion by illusion; torus and fillet and scotia of the base, fluting and entasis of the shaft, ovolو and abacus of the capital, architrave and frieze and cornice,—all have received their due meed of discussion and explanation. Moreover, the idea of linking the whole series of geometrical optical illusions to an all-embracing aesthetic theory is both novel and remarkable. The question is, whether it has been—whether it can be—carried out.

We must admit that Professor Lipps has been able to account for all the optical illusions that are familiar to us from the many recent essays upon the subject. We may admit, too,—at least, this is the impression that I have obtained from the book; I am not sure how far it is a true one—that his principle of explanation has a heuristic value. But serious objections present themselves to his point of

¹ The outline of a similar theory was roughly sketched by Vernon Lee and C. Anstruther-Thompson in the *Contemporary Review*, Oct. and Nov., 1897.

view. (1) Can we travel, without more ado, from the real, tri-dimensional, undoubtedly 'purposive' structure, column or tree or tower, to the superficial or linear figure, the bare line or circle or square? We easily and consciously read our own activity into the former; I have hardly ever found myself doing so into the latter. I can, with some effort, 'feel' the solidity of the black disc on a white background, and the hollowness, emptiness, of the white on black; I can also read movement into the Müller-Lyer lines; and I can sympathize with the smooth or unsmooth flow of the line in the corrected or uncorrected segmental and stilted arch. But in the first of these cases I call to aid a tri-dimensional secondary idea, and in the second and third I seem myself to move with or along the lines, rather than to let them move or carry movement. I should, therefore, incline to doubt Professor Lipps' statement that solidity presents 'in principle' nothing new as compared with superficial extension (*Zeits.*, *loc. cit.*, p. 41), and his conclusion that our apprehension of the plane geometrical figure follows on directly from that of the tri-dimensional structure. (2) But the reply is obvious: the 'reading in' of activity in cases of illusion is 'unconscious,' stereotyped in us by habit; so far from its being necessary for us to realize our personifications, it would be curious if we did so (*Zeits.*, *loc. cit.*, pp. 43, 44). To which I offer the counter-reply: If I am not now tempted in any way by the forms themselves to read my activity into them, why should my ancestors have done this, and done it so much as a matter of course and habit that their attitude has laid permanent constraint upon me? What was so highly conscious once, surely might be at least weakly conscious now, more especially now that I am trying to make it conscious. Professor Lipps has written a 'logic' or 'mathematics' (p. 170) of optical illusion, and his method has led him to rectify certain too general statements of former theories (pp. 220, 147, 271); but unless one is prepared to accept the Herbartian unconscious, with all its implications, one can hardly grant that the theory is psychological. Apart from such school dogma, I can see no reason whatsoever (Professor Lipps complains in his *Festschrift* paper that utterances upon this point are vague) against regarding the great bulk of optical illusions as matters of perception, and not of judgment. (3) A third objection, which I am less confident in urging, is this: Does not the apparent heuristic value of the writer's theory lie in the fact that it is able to adapt itself *ex post facto* to all and every illusion? Professor Lipps asserts or admits (p. 287) that it is a tautology: the primary activity produces the illusion,—but then the 'primary' activity is just that activity which does produce the illusion. There is no arguing with a theory which would find the facts equally intelligible if they were given upside-down; and I cannot help thinking that the present theory would hold its own very well in an inverted world.

Of the general importance of the work there can be no doubt. It is a model of patient constructive argumentation. Psychologists would owe a still greater debt of gratitude to the author if he should now publish a detailed critique of rival theories: there is no one of them, he says (p. 421), which, if taken seriously, does not break down under the weight of factual exceptions. This is a hard saying, and must be tested. In conclusion, I would advise the reader to make an index of figures as he proceeds; the lack of indices means much loss of time.

Professor Wundt's monograph has appeared so lately that any review at the present time must show signs of imperfect assimila-

tion. Nevertheless, it stands in such marked contrast to Professor Lipps' book that some notice must be taken of it in this connection. The work was suggested by, or grew out of, the recent investigation by Thiéry (*Phil. Stud.*, XII, p. 125). The treatment is historical; Oppel's figures are constantly referred to. Here, at once, is a great difference between the two inquiries.

Wundt begins by laying down methodological rules. Complex figures, showing many illusion-motives, must be split up into simpler; figures whose illusion may be due to coincident motives must be varied in such a way as to exclude one motive after another; great weight is to be attached to reversible illusions, since in them the only change of conditions lies in the perceiving subject. As heuristic maxim we have the rule that physiological conditions must be regarded as primary, other things equal, psychological as secondary. (Pp. 1-6. Cf. Lipps, p. vii.)

The investigation sets out from the reversible illusions of perspective (pp. 6-30). By variation of conditions and test of other proposed explanations, the conclusion is reached that "the physiological conditions [of these illusions] consist in the *fixation* of the objects by the eye and the *movement* of the point of regard along definite contours." The irreversible illusions fall, first, into those of extension and of direction. Illusions of each class may be variable (changing in magnitude and perhaps even in quality with change of conditions) or constant. The former are accompanied by irreversible illusions of perspective; the latter either have no such concomitants, or have them under quite different conditions.

We pass, then, to the variable illusions of extension (pp. 30-53). Here belong the illusions of filled and open linear extensions, of the vertically and horizontally fluted square, the optical paradox, Líska's illusion (apparently varying length of line with varying size of inclosed angle), etc. It is shown that the illusion of perspective is secondary, that of size primary. Helmholtz' contrast theory, Müller-Lyer's confluxion, Heymans' movement contrast (cf. *Phil. Stud.*, xviii., pp. 613 ff.) are weighed and found wanting. The illusions are due to the motives to movement of the line of regard which reside in the nature of the objects as given.

Under the constant illusions of extension (pp. 53-61) fall the overestimation of verticals as compared with horizontals, the overestimation of the upper half of a vertical, and the (monocular) overestimation of the outward horizontal. The perspective theory is here out of court: we must fall back upon dioptrical or muscular asymmetry. By elimination, we are left with the latter as the sole explanation. The absence of the illusions in the circle is an indirect confirmation of this standpoint.

The variable illusions of direction (pp. 51-78) bring us to the question of the estimation of angles, to Hering's and Zöllner's patterns. Perspective comes to its rights again, as secondary motive. It is most interesting to compare Wundt's account of the illusion and lack of illusion in the series of superposed horizontal arcs (overestimation of the acute tangential angles and arousal of perspective) with Lipps' discussion on pp. 314 ff. There seems to be no doubt that Wundt's explanation of his Fig. 40 (cf. his analysis of Figs. 59 and 60) explains also Lipps' Fig. 155; but the reader must judge for himself. Wundt accounts for the overestimation of small angles by an extension of Delbeuf's idea: "where mechanical movements of short duration are produced," he says, "but movements which differ in duration in the individual case while their other conditions remain the same, there is consumption of a relatively greater amount of energy in the shorter movement, since it

requires greater energy to start a definite movement than it does to keep a present movement going." Movements of regard, then, are the condition of the illusions.

The constant illusion of upward divergence of parallel verticals is referred, also, to the eye muscles (J. Müller); Helmholtz' attempt at a retinal-image theory is not successful here any more than it was for the preceding illusions. Recklinghausen's illusion in indirect vision is explained by the change in retinal image caused by projection in space as determined by eye movement. (Pp. 78-85.)

So far we have had illusions due to physiological motives. There are others (pp. 85-93) that are due to the direct arousal of the psychological process of association, and that may therefore be termed 'illusions of association.' The illusion here, as in the former instances—Wundt is explicit upon the point—is a matter of sense-perception, not of judgment; but its direct origination is psychological, not physiological. We may distinguish illusions of approximation and illusions of contrast. Typical of the former is the line unevenly divided into three parts, which seems to be evenly dissected; typical of the latter, the Ebbinghaus circle-figures (Lipps, p. 222).

Finally, we reach illusions that result from a complexity of motives (pp. 93-105). These may be wholly physiological (mixture of variable and constant), as in the torus and scotia illusion, the illusions in the triangle, Poggendorff's illusion, Loeb's illusion; or partly physiological and partly associative, as in the interrupted circie of Müller-Lyer, superposed segments, Oppel's double and single circles, etc.

These, then, are the facts. There follows a critique of theories (pp. 105-116). We have the psychological 'mother-theory,' of deception of judgment by imagination. Out of this have come the perspective theory of Hering, Guye, Thiéry; the contrast theory of Helmholtz, Heymans, Loeb (somewhat better is the contrast-confluxion theory of Müller-Lyer); and the mechanical-aesthetical theory of Lipps,—known to Wundt only from the *Festschrift* and *Zeitsch.* papers, etc., not from the book. The author criticises this theory from very much the same point of view as that which I have adopted above, but urges some further objections to it. Just by reason of its aesthetic unity, he says, it cannot take account of the empirical interplay of motives; it neglects the reversible perspective illusions, the secondary perspective ideas, the influence of movements of the line of regard, etc. Wundt's own theory (pp. 116-126) seeks the motives to illusion in the process of perception itself. On the extreme physiological side we have the 'constant' illusions of the text; then come the 'reversible' and 'variable' illusions motivated by retinal-image (fixation) and eye-movement, with their psychological correlate of the 'assimilation' of ideational elements; while on the psychological side stand the 'association' illusions, the result of the interrelation or the reciprocal influence of simultaneous perceptions. The retinal image needs no discussion. And we know that extensive eye movements give rise to sensations; we must, therefore, assume that less extensive movements do so too, only that they are 'fused,' so to speak, in the idea of 'change of position,' just as slight touches are referred to the objects that affect the skin. If the illusion persists for the resting eye, that is because the points of the figure not now fixated nevertheless stimulate the eye to movement, and the 'stimulation' works as actual traversing of the space, actual eye movement, would work.

Professor Lipps' by-the-way remarks concerning eye-movement (p. 310) are, I think, more than met by Wundt's polemic against the

'unconscious inferences' and general logical tendencies of popular psychology. Wundt has shown conclusively that a great many illusions can be explained as visual assimilations, whose physiological conditions are fixation and movement of regard. On the other hand, while I do not doubt that many other illusions are really 'associative,' due to the conscious arousal of associated visual ideas, I cannot find the concepts of 'approximation' and 'contrast' entirely satisfactory. Color contrast, which Wundt instances in connection with them, is, surely, a different thing altogether; it is, as Hering and his pupils have sufficiently shown, a matter of sensation, of physiological changes at the periphery. The 'law of relativity' is too vague to account for the details of illusion.¹ Perhaps it may be possible, by continued investigation, to find a working physiological hypothesis for the outlying group of facts. In any case, the incompleteness of Wundt's account seems preferable, in the present state of psychological knowledge, to the over-adequacy or 'tautology' of Lipps' theory.²

E. B. T.

(68) *Geschichte der neueren deutschen Psychologie.* MAX DESSOIR.
2^o Auflage, 1^o Halbband, pp. 356. Carl Duncker, Berlin, 1897.

One volume only of Dr. Dessoir's history has appeared (1894). We now have this volume, or a part of it, in second edition. Criticism of the earlier output confessed to the author's great diligence in covering an immense mass of literature, for the most part now dead, but pointed out serious defects in matter and in arrangement. The new edition, "eine völlig neue Bearbeitung des Gegenstands," calls for careful scrutiny and evaluation.

The plan of the work shows major changes in matter and form. A new introduction on ancient, mediæval and recent psychology, and a bibliography are affixed. The author's profession of an invariable use of primary sources in the modern period is a timely defense against the charge of inaccuracy. Lengthy citations are avoided and there is an evident effort to shun prolixity. Fuller treatment of the psychology of the last century has crowded out the more constructive part of the first edition, the part of most doubtful value. For the revision of this we must wait.

In Part I, named "Die Begründung der deutschen Psychologie," are sections on Leibniz, Thomasius, Wolff, his followers and opponents, and eclectics. The systems of Leibniz and Wolff have been reconsidered and their essentials presented in much more comprehensive form, while Rüdiger and Crusius, two chief opponents of Wolff, are allowed freer utterance. Nearly double the space has been allotted this division. Part II occupies two-thirds of the volume and gives the development of the "Erfahrungsseelenlehre" in Germany from 1750 to 1800. The corresponding part of the first

¹To be concrete. Suppose that it could be shown that the estimation of the central circles in Ebbinghaus' figures is explicable (say in terms of energy of movement; cf. Wundt's explanation as regards acute and obtuse angles) as an absolute illusion: that the one circle is overestimated, the other underestimated, whether the two figures are given together or not. The contrast illusion would, of course, follow; but it would not be due to the juxtaposition of the two figures, the interrelation of perceptions, but rather to the pre-existence of physiological (assimilative) motives to illusion in each figure. The psychological 'contrast' would thus be reduced to perceptual processes with an intelligible physical substrate. In the meantime, Loeb's assertion of a space-contrast and attribution of space-values to the retinal elements ('space' being on a par with 'color,' e.g.) must remain wholly unconvincing to psychologists, Herbartian or other (see *Zeitsch.*, xvi, p. 298).

²Some of Wundt's statements as to motives to illusion appear, in the light of Lipps' work, to be too sweeping; see the critique of Lipps' theory above. But the necessary modifications can easily be made, without prejudice to the general standpoint.

edition brought the history down to 1780, but was again much more fragmentary than this. Revision and improvement are everywhere prominent. Much more space is devoted to historical summary, and classification is less forced than before. 'Scholastic,' 'natural science,' 'popular' and 'analytic,' are clearly more significant psychological rubries for the period than 'materialistic' and 'anti-materialistic.' The new arrangement permits tardy justice in many cases, as, *e. g.*, Lossius and Irving, who are rightly termed physiological instead of materialistic psychologists. Foreign influences are taken more carefully into account, though the evident importance of the English empiricists to the eighteenth century psychology of experience is not made prominent. Especially Locke, to whose distinction of inner and outer perception the "*Erfahrungsseelenlehre*" owes so much, deserves more attention. Only a half page of generalization is given.

It would be quite useless to profess in this connection a detailed criticism of the summary and evaluation which Dr. Dessoir has undertaken at large, but, failing in this, a somewhat close scrutiny of a bit chosen from the whole and focused with care may do justice to the workmanship of the entire piece. Take, for instance, the work of L. H. Jakob, one of the more important of the lesser men. The system gains in importance by being a titled "*Erfahrungsseelenlehre*" from the end of the century, the psychology whose development consumes a large part of the book. D.'s discussion of the work under the heading "*Assoziationspsychologie*" does it doubtful justice, while it obscures its value as a treatise on empirical or experience psychology. And D.'s caveat against confusing this trend with English associationism scarcely justifies the disposition. The "*Methodologische Richtung*" and the "*Vorliebe für begriffliche Zergliederungen*," which writers of this class show, seem rather to relate them to the analysts. D. makes Tetens' "*Philosophische Versuche*" (1777) the culmination of the empirical trend of the last century. Jakob's system, written fourteen years later, marks an advance in "*Erfahrungsseelenlehre*." While it professes to be psychology of the inner sense, it gives an important place to physiology (*e. g.*, 4th ed., pp. 6 and 215), and inserts in the "*Physiology of the Human Mind*" a discussion of the phenomena of the outer sense in parallel with a discussion of the inner. Empirical psychology has evidently come to mean more than a "pure psychology of internal perception which * * * * completely disregarded the physical conditions of mental phenomena" (Külpe, *Introd. to Phil.*, trans., p. 61). J.'s prime distinction of inner and outer sense is neglected by D. The inner sense is reviewed in two sentences which throw no light on its significance. The first half of the book is better summarized than the last. The more complex faculties are slighted, the method of classification of desires is given incompletely, and the relation of desire to instinct and passion is omitted. Finally, there is no reference made to the contents of the second part of the work on the "*Pathology of the Human Mind*." On the other hand all of the citations from Jakob are verified, and, in the main, are well chosen. If one may judge the detail of the whole by this fraction, one would be inclined to say that the factual reproduction is correct and of unequivocal value. This is of especial importance to Americans, to whom much of Dr. Dessoir's source-material is not available. I will only add that practically all of the minor errors of the first edition, brought out by detailed criticism, stand corrected in the new volume.

(69) *Magic, Stage Illusions and Scientific Diversions, including Trick Photography.* ALBERT A. HOPKINS, N. Y 1897, pp. 56.

The claim of the preface that "this work occupies a unique field in the extensive literature of magic," is well founded. No book has ever before appeared that dealt with these matters in so full and clear a manner. A few books claiming to give *exposés* of stage tricks etc., have been published, but usually they, like the tricksters themselves, have only divulged the secrets of a few worn-out illusions, and have left the great mass still a mystery, and the reader in doubt whether the more startling feats are not, after all, the effects of "occult" powers or "spirits." In this case, however, the author has given us a clear and scientific explanation of all kinds of legerdemain and stage illusions as they appear to the spectator and as they exist behind the scenes.

It is useless to attempt, in a brief review, to give any adequate idea of what the book contains, so full is it of interesting matter.

The introduction by H. R. Evans gives a brief history of magic from earliest times. The five sections of the book are devoted to (I) Conjurors' Tricks and Stage Illusions, (II) Ancient Magic, (III) Science in the Theatre, (IV) Automata and Curious Toys, (V) Photographic Diversions (including trick photography and spirit photography). Nearly every explanation is accompanied by one or more illustrations, so that every detail is made perfectly intelligible.

One is unable to decide which is to be admired more, the absurd simplicity or the elaborate preparation upon which the different tricks depend for their success. Such tricks as the "animated mouse" or "slate writing" illustrate the former, while "disappearances" of many and diverse forms, as well as sudden reappearances, depend upon the latter plan. A good illustration, however, of elaborate preparation is seen in "second sight" or mind reading. For the performance of this feat an elaborate system of signs is used, requiring, one would say, months to learn and make perfect by practice. But when once it is perfected, a little skillful questioning which creates no suspicion on the part of the audience, is all that is necessary to give the operator all she needs to know—all that she gives back to them as the result of her "remarkable" powers.

Presumably all theatre-goers know that many realistic effects are produced by elaborate machinery. But it may be doubted if very many of even constant attenders are aware *how* elaborate, and least of all by what means, the different effects are produced. All this is explained in the section devoted to it.

In fire-eating, sword-swallowing and sword-walking, we pass from trickery pure and simple to the realm of marvels accomplished by pure skill on the part of the operator. The sword is actually swallowed and its point reaches to the bottom of the stomach. We are here told how it is done.

Space will not permit of further mention of marvelous and interesting things herein contained. The work is valuable and timely. The psychologist will find here, ready prepared, many illustrations of psychic principles. To one studying the psychology of occultism the facts here given will prove very valuable. Teacher and parent alike will find it useful, since one can hardly imagine anything more calculated to stimulate a boy's imagination and ingenuity than such a mine of marvelous feats that he can learn to perform, interesting toys that he can make, which are at once instructive, fascinating and innocent. The facts set forth constitute a forcible proof that our organs of sense are not infallible, and secondly, it is evident—

a fact that has been too little appreciated in all discussion of such matters—that no expense of time or money is spared, or scientific principle neglected, in order to produce something that shall pass for marvelous.

A bibliography of 160 authors will be appreciated by psychologists and all others who may wish to investigate the subject. G.

(70) *Les éléments du caractère et leurs lois de combinaison.* By PAULIN MALAPERT. Alcan, Paris, 1897, pp. 302.

Every one interested in the subject of Mr. Malapert will find this book very profitable reading. The author is not very original, a fact which he himself acknowledges again and again; and he does not claim that he proposes a classification which is worthy of being called new. But he offers a very conscientious study; he knows his subject thoroughly, and, it seems to me, that he is especially successful in his mild criticism of authors who have dealt with this subject before.

First of all Mr. Malapert denies the necessity of considering the physiological aspect of the question as the basis of the whole problem. He proves clearly that even the authors who advanced physiological causes were finally forced to admit that they, after all, really used psychical arguments in their studies and especially in the classification of characters. Pages 7-9, he gives a very good criticism of Mr. Fouillée's theory of temperament, founded on biological causes. Pages 14-15, he gives his own point of view.

Where have we to study character? Mr. Malapert admits that the nucleus of character is individual, and is innate with us. The external conditions, milieu, climate, etc., may only modify, but do not create this primitive nucleus. (He tries to show here that H. Taine, who has often used a very sharp language indeed, has been generally misunderstood.) It would seem, then, that the place where the very essence of the character is to be studied is with the child. But, says Mr. Malapert, there character has not yet had occasion to manifest itself. On the contrary, only with the adult we may study character in its whole development: at the age of twenty or twenty-five, but not earlier, man has had occasion to show all the different aspects of his character.

First Part. In order to avoid the one-sided theories on character found with his predecessors, Mr. Malapert, before offering a classification of character as a whole, proposes four classifications, one for each element constituting the character as a whole. Classification according to sensitiveness, to intelligence, to automatic will, and to voluntary (that is, conscious) will. All of these classifications rest on a single principle, that of *more and less*. I can not enter into any details here; there are a great many sub-divisions for each of these large classes.

Second Part. This part gives us the laws of the combination of the elements of the character, the different degrees of sensitiveness of intelligence, and so on. Like the rest of the book this part also is worked out very carefully. But there is no strict order in the arrangement of the matter. This is not meant as a reproach, for, if such order existed, it would presuppose a single principle to direct us. But as Mr. Malapert himself recognizes, we have not yet advanced so far in the study of character as to arrive at unity. The fourth chapter shows this very clearly. After a short exposition of the most valuable classifications of character made within the last few years, and an excellent criticism of the most important failures in each, the author offers, as being the best within the present reach, a combination of the theories of MM. Fouillée and

Ribot. (Apathiques—Affectifs—Intellectuels—Actifs—Tempérés—Volontaires.) As will be readily seen, the author does not assume the responsibility of giving the preference in classification either to sensitiveness, or to intelligence, or to will. Consequently he presents a mixture void of all unity. Perhaps, when we shall have arrived at a better and more thorough knowledge of the essence of these three faculties, we shall be able to decide. As far as one can judge now, it seems to me that intelligence should be considered the leading faculty. The fact alone, that, except when one has phenomena entirely automatic to deal with, the intellectual element is never wanting, while the elements of sensitiveness and of will are very often completely absent, would constitute a strong argument in favour of intelligence.

Third Part. In the fifty last pages of the book, we have the theories of formation and development of character which we have just studied in its broadest and most many-sided manifestations. I only mention the fact that in the problem of the influence of will, Mr. Malapert finally takes his place among the Neo-Criticists, and especially he shares the view of Mr. Renouvier. This does not seem to me to be a very valuable feature of the book. The "formula" the author arrives at in his conclusion: "It is the duty of every one to have a character" (*Le devoir pour chacun, c'est d'avoir du caractère*), is in fact nothing but words. However, the book loses none of its value on account of this; it is the best means of becoming acquainted with the present state of researches in this very important chapter of psychology.

A. SCHINZ, PH. D.

(71) *Essai sur l'obligation morale.* By GEORGE FULLIQUET. Alcan, Paris, 1898, pp. 450.

Mr. Fulliquet is an author who became celebrated some years ago by his book, "La pensée religieuse dans le Nouveau Testament." I can but regret that he has abandoned the field of theological studies as well as the field of historical researches, for in both kinds of work he is a man who can do much towards the advancement of science. His "Essai sur l'obligation morale" is a new assertion (exactly as the book of the Abbé Piat, which will also be reviewed in this number of the JOURNAL) of ancient philosophy in opposition to recent theories to-day prevalent in Ethics. Mr. Fulliquet has many qualities in common with old philosophers; among others prolixity (his essay consists of no less than 450 large sized pages) and a great talent for repeating well-known ideas, and even ideas he himself has already developed in other parts of his book. I admit that the author has a great talent of exposition and a very good style. I admit, also, that his way of argumentation is in general on a higher level than that of the Catholic author I spoke of. I admit especially that his intentions are excellent; but I do not admit that such philosophical publications are of any value. It is beautiful; it is elegant; it is sincere; it is generous—in a word it shows the spirit of the metaphysical publications in France, but it is not scientific. Besides, in spite of all his efforts, the author does not do justice to the philosophy of to-day. If he himself recognizes that the theory of "Libertas Indifferentiae," with the so-called Ass of Buridan, was proposed before Aristoteles, and if, on the other hand, the scientists are not willing to accept it, there must certainly be some very good reason for it. And if even they should decidedly be wrong, then the partisans of liberty must have other arguments to offer than such as have been proposed over and over again, and which have proved unable to compel silence among determinists. Every one knows that the partisans of liberty affirm

that determinism does not account for all phenomena in our life, and consequently it is unnecessary to have a very long discussion upon all those arguments familiar to philosophers; why insist so haughtily upon the influence of the idea of liberty, conscience of liberty, duty? etc. Even the step from moral obligation to the idea of God (which is here, I must say, clearer and brighter formulated than anywhere else, as far as I know) is not new to anybody. And still the same as for a possibility of liberty on account of the free choice between two determined possibilites, this theory exposed not only by Prof. James, whom the author quotes, but by quite a number of philosophers centuries ago.

Another point is that Mr. Fulliquet has no right to say that any philosopher has ever refused to admit the existence of moral obligation; some only refused to admit that the origin of this obligation has to be looked for in a transcendental world, or simply outside of the world, and of the chain of causes and effects—that is quite different.

Finally: Mr. Fulliquet distinguishes two kinds of obligations: (1) the moral obligation, and (2) the obligations by egotism, by intelligence, by association, by the ideal, and so forth,—and he concludes therefrom: the obligations of the second kind being not liable to be conceived in the same way as moral obligation, they are not really obligations at all. Now, would it not be possible, and for reasons just as good, if not better, to say: If moral obligation in the sense of Mr. Fulliquet is not liable to be conceived like the other obligations *for which we have a rational explanation*, it is not really an obligation in the sense we can give to this word in the ordinary--the rational--way of speaking.

As for the substitution of an "unconscious ego" as the creator of free acts, in the place of an "intelligible ego" with Kant, it seems to me rather a difference of words than of notion.

It is of no special interest to speak here of the history of ethics, that is, the exposition of some systems of ethics in this century (Kant, Schopenhauer, Mr. Renouvier, H. Spencer, Ch. Scerétan, Mr. Fouillée, Guyan). This part of the book also offers nothing new: there have been very able publications of this kind before the one by Mr. Fulliquet.

I wish to say, in closing, that most of the above criticism applies not only to Mr. Fulliquet's book, but to all those—so numerous today—which take up well-known problems in an antiquated way.

A. SCHINZ, PH. D.

- (72) *Essai sur les conditions et les limites de la certitude logique.*
By G. MILHAUD. 2^e édition revue. Alcan, Paris, 1898.

The author belongs to the class of thinkers who are gradually taking the place of the French "Spiritualistes" followers of Cousin. Their most important representative is Mr. Boutroux. The book, "De la certitude logique," belongs to the same category as "De la contingence des lois de la nature," by Boutroux, and the "Essai sur les données immédiates de la conscience," by Bergson. All of them agree with modern science and its methods; even the neo-Kantian school of Renonvier does not satisfy their wants of exactitude. On the other hand, however, they try to escape from the results of the new science, and they elaborate their theories on the basis of the science of Logic.

The most evident principle of science is the principle of contradiction; and it is this very first principle, the consequence of which Mr. Milhaud attacks sharply, as soon as these consequences are applied outside a certain field of speculation. He distinguishes

between the *objective* knowledge, which is given to us, and the *subjective* knowledge, which is *constructed by us*. Science is based entirely upon subjective knowledge: we accept definitions, and on this ground we build up science; but all our definitions are conventional, relative. We admit them as a result based upon a certain amount of facts, but we never know whether there are no other facts which perhaps might not correspond to the definition; and as we never know whether we have cognizance of all possible facts connected with an absolute definition, the result is that "no lurid mind will ever have the right to declare a hypothesis as definitive" ("Jamais un esprit éclairé n'aura le droit de déclarer une hypothèse définitive.") He attacks the positivist method on its own ground. He takes advantage of the concessions of Stuart Mill, in his "Philosophy of Hamilton," but pushes the theory to the very end. Not only must Mill be able to recognize that something entirely black may at the same time be white, and that a round object may perhaps be square, and that 2×2 are possibly 5, but in order to remain consistent, Mill has no right to hesitate in admitting that *A* may at the same time be *non A*.—Consequently, and that is the object of the whole demonstration, we can never condemn any theory on account of its relation with some other theory. Since we are the authors ourselves of our science, we have constructed it with elements invented by ourselves; and it may be perfectly possible that our science is wrong.

Mr. M. verifies his theory on mathematics, and applies it to moral liberty, the non-Euclidian geometry, and the solution of the antimonies of Kant by Mr. Renouvier.

I do not agree with the author in the conclusions he arrives at. If the theoretical scepticism he asserts has to be applied also in practical life—and it is the very reason for the theory, to save in that way moral liberty—I hardly see how science would be of any use to us. And yet if we may judge according to the past of science, there is no reason to doubt the practical value of the experimental and positive methods—no matter what the psychological origin of the method may be. However, it is a very interesting book, and one may derive great benefit in reading it.

A. SCHINZ, PH. D.

(73) *L'individualité et l'erreur individualiste.* FÉLIX LE DANTEC.
Alcan, Paris, 1898, pp. 175.

Within a few months this is the third book published by this author. It is not very surprising, therefore, that he takes up the largely the same topics not only in every book, but in the different chapters of each volume. We cannot expect from a scientist that he should collect each month matter enough to fill a new book. . . . Mr. Le Dantec is a fighter, and since his physiologically-deterministic ideas were attacked sharply, he thinks it necessary to defend himself again. It seems to me that there was no reason for being surprised when, for instance, Catholic reviewers of his earlier books expressed views different from his own. Mr. Le Dantec is like so many writers of to-day who fail to recognize that the public consists of two classes of people: the scholars and the readers untrained in philosophy. I am sure that among the first class nobody would disagree with Mr. Le Dantec in his deterministic views; and if some do, it is only for reasons of sentiment, as the author says himself; they do not introduce the liberty, that is, the belief in an interruption of the strictly necessary sequence of causes and effects, within their scientific deductions. Whatever their conviction may be as to the existence of moral liberty, their

method of researches in physiology remains the same—and that is the important point.

However, one thing astonishes me, and that is that Mr. Le Dantec, in looking for names to give to the representatives of the two methods of investigation, he adopts that of *psychologists* for all those who refuse a sound scientific method. It would seem to me that, even if some ten or twenty years ago one had any right to classify in this manner in France, to-day it is entirely out of place in the country of Ribot, Pierre Janet, Binet, and other prominent psychologists, as well as in any other.

"Individualism" which he wishes to remove is hardly worth dwelling upon, since its manifest inanity has been recognized by every one. Not only does the *milieu* change from one moment to another, modifying our way of thinking, feeling and willing, but the individual himself who thinks, feels and wills is liable to change; physiological modifications of his being take place with him and influence his mode of psychical reaction; man is not like a stone which ever remains the same.

Let me point out an interesting discussion and successful refutation of the Archesethetism of the late E. D. Cope of Philadelphia.

I need not to call attention to the lucid article on Physiological Senescence which appeared in the *Revue Philosophique* last year. Senescence is due to the outweighing of the muscular substance by the conjunctive or skeletal substance of the muscle.

A. SCHINZ, PH. D.

(74) *Comment naissent les mythes.* PAUL REGNAUD. Alcan, Paris, 1898, 249 pages.

The sharp contest on the problem of the origin of myths continues. Our author takes his position midway between the philologists of the school of Max Müller, and, more recently, of Oldenberg in Germany, on the one hand, and on the other the psychologists, as Gaidoz in France and especially A. Lang, in England. Mr. Regnaud develops more fully the point of view of Bergaigne, which he had already accepted in his former publications.

The origin of the Indo-European mythology is found in the Vedahs. Simple figures of speech (metaphors) in Vedic hymns were converted into realities or personifications. For instance, *agni*, the soul, before its development is accorded a very small place in the heart of man; it is considered as short as a thumb, thence the name of *pouce*, the little thumb. All the different features of the story, not only the name and the persons, but its very elements are explained in such way. In the Vedic hymns there is no story yet; the imagination only brought together the elements in them, and finally composed the myth of the little thumb.

The same explanation holds good in the case of the Deluge. The idea of such an event has its origin in the substitution of the legend which we all know, to a figurative description of the elements of sacrifice, when the religious act is about to take place or is actually performed.—And the same for other myths.

Any one who would hear such an explanation for the first time will find it hard to accept. However, after having conscientiously read the book of Mr. Regnaud to the end, it seems evident that there is a truth in this theory. But, on the other hand, the author seems to me unjust in his attitude towards the new school, and particularly towards its head, A. Lang. If in the myth here offered for consideration we might possibly agree with Mr. Regnaud, it does not result therefrom that that would be the case everywhere else. The psychological thesis, that the same myths found in dif-

ferent places were formed independently one from the other, according to the uniformity of the thought of man in the different parts of the globe, seems to me just as well applicable to many mythological stories. It is not necessary to presume that all myths have sprung up in exactly the same way. Different theories may be alternatively correct.

A. SCHINZ, PH. D.

- (75) *Problèmes d'esthétique et de morale.* C. R. C. HERCKENRATH. Alcan, 1898, 163 pages.

a. *Esthetics.* The author tries to arrive at a theory of beauty by way of psychogenesis. The beautiful, he says, consists, with children and savage people, in a simple and ingenuous combination of the elements of the beautiful object, especially color and sound. Gradually the simple becomes tiresome and we look for other and more complicated combinations of colors and sounds. The artist who, during his whole life, is dealing with such matters, acquires a very fine taste which ordinary people do not arrive at. Taste changes, and although not disputable in individuals is capable of progress at any time. "Good taste—that is, the conclusion—is a taste more refined, more cultivated than bad taste" (p. 46).—It is the first time, so far as I know, that intellectual theories have been applied so thoroughly to aesthetics, and I cannot but think that this way of treating the problem of beauty is full of promise. The chapters on the Sublime, on the Problem of the Tragic, and on the Comic Art and Laughing, do not offer the same originality and freshness of thought as the one on the Sense of Beauty, although the intellectual element is also not lacking here.

b. *Ethics.* The chapters grouped under this head, "Le Problème Moral," show a still greater lack of originality. The author evidently has never studied very thoroughly any history of ethics, for if he had, he would have remarked that all his theories are very old. He seems to believe, for instance, that he has found out (by correcting and completing Schopenhauer) that *sympathy* is the irreducible element of morality, while every one knows how often this principle has been advanced as the basis of ethics, and that even often the very word has been used, e. g., Adam Smith. Besides, the intellectual element is not so thoroughly carried through in the second part of the book as it was in the first.

A. SCHINZ, PH. D.

- (76) *La personne humaine.* L'ABBÉ C. PIAT. Alcan, Paris, 1897, 401 pages.

All views and opinions are represented in the excellent collection, "Bibliothèque de Philosophie Contemporaine," of Mr. Alcan. The author of this book is a dignitary of the Roman Catholic Church, who takes up the old idea of human personality and of the soul, and tries to maintain its efficiency on contrast to modern phenomenism. His argumentation takes up 400 pages, but without advancing a single argument that has not been presented a thousand times before.

I doubt very much whether arguments which were not able to check the progress of modern psychology when advanced for the thousandth time would have this result after the thousandth and first time.

Further, even if one would be perfectly willing to admit that definitive solutions of the problems of the soul or mind have not yet been given, that would certainly not necessarily imply, as Mr. C.

Piat seems to think, that the new phenomenistic theories have to be considered as entirely wrong.

I will give in a few words the ideas as represented by the Abbot:

I Part. The *Perception*, which man has common with animals, gives us already the feeling of the continuity of the "Ego." And this consciousness is so strong that it cannot be given up: science will never prevail against the inner experience.

II Part. The *Reflection* belongs to man alone. The theory of transformism claims that reflection is only a prolongation of organic process. But, says the author—whose answer here is not so definite as in the first part of the book—the theory the transformism arrives at, cannot yet be considered more than an hypothesis.

III Part. The *Sense of Responsibility* is the final and decisive argument against phenomenism. Liberty is conceivable, since conscious causes are different in quality from the unconscious or physical causes. Duty imposes itself and consequently the old theories concerning the human conscious personality gives a more-satisfactory explanation of the reality than the modern theories.

A. SCHINZ, PH. D.

- (77) *Einige Experimente über Gesichtsbilder in Traum.* By PROF. J. MOURLY VOLD. Dritter Internationale Congress für Psychologie. Munich, 1897, pp. 355-357.

The experiments on dreams, reported to the Psychological Congress at Munich by Professor J. Mourly Vold of Christiania, suggested to the writer a study of the visual element in the dreams of his students in the State Normal School at Westfield, Massachusetts. Each member of a small class in senior psychology was provided with a set of the following objects—eleven in all—cut from colored paper: a square (green), $1\frac{1}{2} \times 1\frac{1}{2}$ in., and an octagon (light violet), cut from a square, $1\frac{1}{2} \times 1\frac{1}{2}$ in.; a square (red), 2×2 in.; and the following objects cut from squares, 2×2 in.; a heart (violet), a robin (green), a coffee-cup (light yellow), a Maltese cross (blue), a circle (pink), a triangle (blue), a hen (light green), and a cat (light blue).

The conditions imposed were similar to those mentioned by Professor Vold: The objects were to be spread out on a white background, intensely observed from two to ten minutes just before retiring, and the light extinguished without looking at the flame. The experiments were to be made on ten successive nights, and the details of the remembered dreams written out the mornings following. Fourteen women—ranging in years from twenty to thirty—fulfilled the conditions of the test and reported 221 dreams. The largest number of dreams reported by any one member of the class, for the whole period of ten nights, was thirty-five, and the smallest number seven.

Color was a pronounced feature of forty-seven of the dreams. Red was reported seventeen times; green, six times; blue, white, yellow, and black each five times; violet, three times; and gray once. In eighteen of the dreams, the color element was attributed directly to the colored papers observed, and the forms of the colored papers—as the hen and cat—accounted for eleven more of the dreams.

A strong visual element was reported in 133 of the dreams, a marked auditory element in ten, and a pronounced motor element—riding, running, or falling—in twenty-three of the dreams. Fifty-seven of the dreams refer to family and friends; thirty-three to present vocation; twelve to sickness, death, or accidents; ten to personal appearance—chiefly dress; fifteen to animals and six to plants.

The emotional state in twenty-one of the dreams is reported distinctly painful; twelve as pleasant, and four as perplexing. Three dreamed that they were being chased—one by a cat, one by a man, and one by a peacock. The cat, the dreamer thought, might have been suggested by the observation of the one cut from colored paper, and the student who dreamed of being chased by a peacock suggested that possibly the hen and the combination of colors might have laid the foundation for this dream.

But seventy-nine of the dreams were localized in the recent past—within a fortnight—and sixty-three were localized in the remote past—more than a year before. Several reported that although they dreamed of incidents associated with their early childhood, their apparent age was never lessened. One hundred and fifty-six, or about 70 per cent. of the dreams, were satisfactorily accounted for as having some connection with the thoughts and experiences of the preceding day or week.

WILL S. MONROE.

- (78) *The Evolution of the Idea of God.* By GRANT ALLEN. Henry Holt & Co., New York, 1897, pp. 447.

This is a very convenient résumé of the work of Herbert Spencer on "Ecclesiastical Institutions," Fraser's "Golden Bough," Mannhardt's "Baum Cultus," Robertson Smith, Tylor, Speth, Hartland, Baring-Gould and other writers known to folklorists in this field. A more fit title would have been: "Beliefs and Rites of Ancient People who dwelt about the Mediterranean as the Source of Christianity." The author has collected material for twenty and been writing the book for ten years, and states that every question of the objective validity of any belief is foreign from his purpose, tells us that he is not such a "gross and crass Euhemerist as to insist dogmatically on the historical existence of a personal Jesus," does "not pretend in any one instance to have proven my point," but only to have made out a *prima facie* case for a grand jury, etc. His "case" is, after digesting the arguments of Frazer and Mannhardt, the indebtedness to the latter of whom he and Frazer scarcely recognize, that among the gods deliberately made by killing priest-kings and their substitutes, corn and wine gods were especially prominent, that Jesus, whether or not He ever really existed, is simply another corn and wine god manufactured by killing. His talk was of vines and branches, eating his body and drinking his blood, a sower, workers in a vineyard, mustard seeds, leaven, harvest, bread of life, water made wine, and a legend made his complexion the color of wheat and his hair of wine. Many other details indicate the same conclusion. While these elements may be present, we think this author unduly magnifies their importance, and that his method is uncritical, and in strong and unfavorable contrast to that of most of the authors whose ideas he here compiles. He follows Spencer's ghost theory of the origin of gods, and wrests facts of other authors who hold the opposite view of animism to support his theory.

- (79) *A History of Dancing from the Earliest Ages to our Own Time.* From the French of GASTON VUILLIER. D. Appleton & Co., New York, 1898.

This luxurious quarto has twenty full-page plates and 409 illustrations, and is supplemented by a sketch of dancing in England by Joseph Grego, and combines scholarly and popular qualities into a happy result. The reader can form a pretty clear idea of what the

pavane, bolero, cachucha, prado, rigadoon, gavotte, polka, maiade, farandole, bayadère, branle, strathespey, ranelagh, alfresco, mabile, and many other dances once immensely in vogue, but now nearly forgotten, really were. In some lands every province has its own peculiar dances; semi-savage dances mimic the characteristic actions of almost the fauna of the country. Every human vocation is represented; every emotion expressed; every form of asceticism, ecstasy, and worship have their dances, so do every typical stage, epoch, event and act of life, and every low passion.

- (80) *The Non-Religion of the Future.* By M. GUYAU. Henry Holt & Co., New York, 1897, pp. 543.

The basis of religion is in man's social nature. It is universal socio-morphism. A man is religious only if and when he superposes another society more powerful, cultured, universal, and cosmic upon his own. Theology is an attempt to explain theology by analogies drawn from human society. Religion is destined to vanish, like Comte's theological stage of thought. Metaphysical, philosophical and scientific ideas will take its place. Children should not be taught religion, so that there may be no need of convulsive reconstruction later. In one chapter we are told how a new husband, whose wife is virgin in soul, should at once but wisely begin her religious enfranchisement before she limit his own mental freedom by exerting the opposite influence. Religion is collective life, not human only, but cosmic. Immortality may be sought by good works, and personal post-mortem continuance is regarded stoically as a bare possibility.

- (81) *Memory and its Cultivation.* By F. W. ELDRIDGE GREEN, M. D., F. R. C. S. K. Paul, Trench, Trübner & Co., London, 1897, pp. 311.

This book is in the International Scientific Series, but is unusually disappointing. There is no reference to literature, or, I think, to any of the experimental studies of the subject in recent years. The brain chart, which is the frontispiece, suggests nothing whatever of the work of the last score or so of years, and phrenology, with thirty-nine faculties and stories from Abercrombie, and fifty-one pages and twenty-two rules on cultivation of memory, conclude the work. All sensory impressions, we are told, are permanently stored in the thalamus; but at present we do not know where the faculties are located. In the absence of almost everything popular on the subject, it is possible that there may be somewhere those who can derive good from such a work.

- (82) *A Course in Experimental Psychology.* By EDMUND C. SANFORD, PH. D., Assistant Professor of Psychology, Clark University, Boston, 1897, pp. 449.

This volume marks the completion of Part I on sensation and perception. As was to be expected, the larger part of the book is taken up with the eye and vision, the other senses being treated in 89 pages. It is copiously illustrated, well printed and indexed, and, so far as the writer knows, unique in its field in any language. The first half was published two years ago, and has been extensively used, and its completion will be welcomed.

- (83) *Studies from the Yale Psychological Laboratory.* Edited by EDWARD W. SCRIPTURE, PH. D. Vol. IV, pp. 141.

This, fourth of the series, contains seven articles, the longest being an "elementary course in psychological measurements" by the

editor. The four studies together, published since Oct. 1, 1893, show a high degree of productivity at the Yale Laboratory, which few in the country can surpass, and indicate a remarkably good equipment considering the relatively limited means at the disposal of the department, and, in connection with the two other volumes published during the time, great industry.

- (84) *Psychologie des Seetes.* Par SCIPIO SIGHELE. Paris, 1898, pp. 231.

This interesting and important book, here translated into French by L. Brandin, is by the author of "La Foule Criminelle," and is an even more important work. The author is more critical and detailed than Le Bon, whom he excoriates, and presents an interesting and comprehensive review of collective psychology, past and future; a classification of crowds; treats at length the differences between sects and parties; the power of leaders; their uniformity and tactics, and their dominant instinct of revolt. The morality of sects is then discussed; their want of equilibrium and permanence; their criminal propensities, and the work closes with an arraignment of parliamentarianism.

- (85) *La Timidité.* Par L. DUGAS. Félix Alean, Paris, 1898, pp. 167.

Social timidity, or excessive bashfulness, is due to lack of sympathy with others, to awkwardness or stupidity, or extreme susceptibility. It is not entirely a physical emotion, and is associated with aboulia. It may be spontaneous or reflex, and this distinction constitutes its two types. Intellectual timidity is fully treated. It is neither a vice nor a virtue, but may come to have high moral virtue if rightly treated.

- (86) *Évolution Individuelle et Hérédité.* Par FÉLIX LE DANTEC. Paris, 1898, pp. 308.

In this theory of quantitative variation scissipare monoplastids are first described in their modes of assimilation, adaptation and correlation, and then monoplastids with their evolution. The second part treats polyplastids, then individual development, and their modes of co-ordination and their laws of heredity. The third part is devoted to discussions of embryonic acceleration, the inheritance of acquired character and telegony, or the influence of the first male.

- (87) *Wild Traits in Tame Animals.* By LOUIS ROBINSON, M. D. Blackwood, 1897, pp. 329.

These familiar talks are intended as an introduction to evolution, to show plain people with a taste for natural history, illustrations of Darwinism right about them. The animals selected are the dog, horse, donkey, cattle, sheep, goat, pig, cat and poultry. There is much allusion to traits called social and even political. The volume is of much interest to psychologists.

- (88) *Theoretical Ethics.* By MILTON VALENTINE, D. D., LL. D., Professor of Theology in the Lutheran Seminary at Gettysburg, Pa. Chicago, 1897, pp. 232.

This is the outcome of many years of teaching and lecturing, and treats the fact of moral distinctions, their faculty or essence, and the nature, supremacy, moral agency, and reality of right and

wrong, ethical views under ethical teaching, and the ethical task under Christianity.

- (89) *Dynamic Idealism.* By ALFRED H. LLOYD, PH. D. Chicago, 1898, pp. 298.

This is an elementary course in the metaphysics of psychology, and was given in lectures at the University of Michigan. The first duty of psychology is to give a distinct, explicit doctrine of the soul. Psychology without metaphysics is useless. Part I considers the world of things, part and whole, change, organism of the body, outer world, and language. Part II treats ideas in form of historical illustration, ideas—not forms—but forces, illustrations from education, body, mind, soul, time; dynamic vs. formal idealism, consciousness as intellect. Part III treats the world of acts, reaction and will.

- (90) *A Compendium of Insanity.* By JOHN B. CHAPIN, M. D., LL. D. Philadelphia, 1898, pp. 234.

The author is physician-in-chief of the Pennsylvania Hospital for the Insane, and his book contains a concise statement of the clinical aspect of the various abnormal mental states, with directions for treatment and management, together with a few illustrations. It is unique in being brief, and will on that account be welcomed by physicians and students, and it will prove useful for members of the legal profession interested in forensic medicine.

- (91) *La Fatigue Intellectuelle.* Par A. BINET et V. HENRI. Paris, 1898, pp. 338.

This is a comprehensive treatment of mental fatigue with 90 figures, and will be reviewed at length later.

NOTES AND NEWS.

RATIONAL FEAR OF THUNDER AND LIGHTNING.

The suggestive *questionnaire*, Study of Fears, in a late number of this review (Vol. VIII, No. 2), points out "the fact that this fear leads all the others, and as that yet so small a fraction of one per cent. of deaths are by lightning, show that, as yet, our correspondents have not adjusted their scale of fear to that of danger. Perhaps nowhere is the power of noise to control feeling and to excite imagery so well seen" (p. 203). Is it not, then, most remarkable that the most prominent of all fears is the most baseless? And how shall evolutionary psychology reconcile this fact with its prime assumption that mental functions originated in and are developed through utility? Even if it be granted that mentality often develops, especially in earlier life, against utility, it is hard to see how such a prominent yet useless and harmful fear escaped being eliminated by natural selection. The biologist who would find a correspondingly prominent bodily function and organ would unhesitatingly pronounce that it must have grown up in the struggle for existence, or what is implied therein. Does it not seem unlikely that mentality in such a form as fear of thunder and lightning is a mere morbid phenomenon, a mere perversion, especially when we note that civilization and complete maturity do not erase it? Indeed, among savages, as Lumholtz noted among the Australians, the electric discharges merely excite to joyous dancing and gesticulation, just as is often noted in children. Further, many beasts, as particularly the *felidae*, the puma, lion, etc., are joyfully excited by thunder-storms, whereas the civilized dog is apt to slink under the bed. The bang and glare are gratefully stimulating to crude sensation, and as the direful effects of lightning are so rare in inexperience, it is difficult to understand how the great fear of thunder and lightning arose and developed under natural evolution. We know how quickly wild animals adjust themselves to the roar of the railway train and glare of the headlight; and it would seem that thunder and lightning is an analogous case, that the phenomena, as such, would come to be taken as a matter of course, and particularly by the more highly developed. That the fact is directly opposite to this biological deduction, certainly suggests an interesting problem. And, as has been implied in our remarks hitherto, menace, or shock to eye or ear, is far from accounting for this phenomenon.

As perhaps throwing some light on this subject I will relate an experience of my own. One afternoon last summer when the sky was slightly overcast, but neither thunder nor lighting apparent, I was walking on the street, when I was suddenly arrested by a peculiar sensation, as if some subtle atmospheric influence was swaying through me. As this increased, a strange and obscure fear took possession of me, and for some moments I was rooted to the spot, and deeply oppressed by a peculiar dread. The experience lasted, in all, for perhaps a minute, and during the time I was perfectly self-possessed, and my aroused scientific curiosity was closely observant of the situation and emotion and searching for the cause. I

knew at once that it was not a mere subjective phenomenon, but the objective source was entirely unexplained till I afterward learned that at the exact moment of my singular experience a most violent magnetic storm had swept over the country. That this pulsated through me, bringing a great oppression and fear, is the only explanation I can give. And I remarked that the oppression and fear were not merely at the sensation, but were mainly involved in it; that is, the nervous disturbance was directly correlated with the depression and fear. Now, my electrical sensitiveness is very great, and I remember on one occasion to have felt electrical disturbance from a small storm passing to one side at the distance of more than a mile from me, and to which I was perfectly regardless at the moment; and I am disposed to believe that the uncontrollable irrational fear which often possesses me during thunder-storms is largely and directly based on nervous disturbance produced by the violent electrical changes. This idea is strengthened when I remember having gone through an extremely bad thunder-storm with almost no fear merely because I had taken refuge in a large church, where, I take it, the mass of dry air acted as an insulator. While I knew churches were quite liable to be struck by lightning, yet I was little disturbed. The suggestion that I have then to make is this, that certain types of highly organized nervous systems are very responsive to electrical changes, these producing directly great mental disturbance involving fear. I conceive that another type of nervous organization might only have felt exhilaration and joy in the case of the magnetic storm I first mentioned, another might have been angry, another have been quite unresponsive. The changing phases of electrical tension in the air, not only in case of storm, but the ever changing electrification, daily and seasonal, undoubtedly stimulates nerve activities in varying ways according to temperament and idiosyncrasy. A highly nervous gentleman, whom I told that for myself railway travel shook me up pleasantly, replied that for himself it shook him down unpleasantly; which illustrates how oppositely the same stimulus may work—upon one for exhilaration, upon another for depression. On the whole, then, I believe that fear of thunder and lightning is, in some wise, a necessary incident of a certain nervous organization, and has its immediate explanation by physiology rather than psychology.

As further investigation of the subject I would suggest that a *questionnaire* on the experience of persons in the rare magnetic storms might be useful in pointing out matter for research. The experience I had last summer was entirely unique for me, but like experiences may be common. Again, direct experiment in changing the form and tension of atmospheric electricity might easily be made upon persons, who, however, should be taken unawares and unexpected. For instance, the nervous invalid mentioned on p. 201 of the recent article on Fear in this review, might, unknown to herself, be variously insulated during storms, and the nervous and mental effects noted. I urge particularly that the person who is experimented on should be kept in entire ignorance of any experiment, for nothing vitiates and complicates psychological experiment more than expectancy, often complex by the agent. As a practical matter I may mention that I find that during a thunder-storm a slow pacing back and forth, breathing very deeply and slowly, will greatly relieve nervous and mental agitation, and I think that a subterranean chamber would give perfect relief.

HIRAM M. STANLEY,
Lake Forest, Ill.

In the February number of the *Atlantic Monthly* Professor Münsterberg publishes a sharp criticism of Dr. Scripture's recent book, "The New Psychology." Dr. Scripture is an extremist upon the quantitative side in experimental psychology. The whole of mental life must be brought, whether it will or no, under the physical categories of time, space and energy. And if the psychological facts are at all discomposed by the arrangement, finding themselves in strange company and not knowing where to look for their friends, why, so much the worse for the facts; they must get used to it. Professor Münsterberg is equally extreme upon the qualitative side; you cannot now, he says, and you never will measure a mental process. The reference to physical categories depends upon a quibble; you go to a book for the time-relations of consciousness, and what you find discussed is the consciousness of time-relations, and so on.

It is not profitable to interfere in discussions of this sort. They are incidental to the present status of the science of experimental psychology, and the two combatants in the case before us are fully able to take care of themselves. Dr. Scripture may, if he will, fall back upon Professor Cattell's paper on "Mental Measurement," published in the *Philosophical Review* some five years ago; and Professor Münsterberg may feel his position strengthened by what Dr. Wolff has recently said in the *Zeitschrift* about the psychological experiment. *Magna est veritas et—ultimately—prævalebit.* There is, however, one point which the *Atlantic Monthly* article includes in the issue, but which seems to be really separate from it, that may be treated as a matter for itself, without intrusion into the controversy: the question of what experimental psychology may be expected to do for the teacher. Professor Münsterberg thinks that it will, as it can, do nothing. We cannot share this opinion, for the following reasons.

Every mental process may be looked at in two ways, as existence or as function. Whether we can measure sensations, regarded as existences, has long been debated in experimental psychology; and the outcome of the debate is still to be expected. Of course a pressure sensation called forth by a 2-lb. weight is not analyzable into two pressure sensations of 1 lb. each; and the visual perception of a blood orange is not a fusion of the visual perceptions of three tangerines. The question is only whether such considerations are the alpha and omega of existential measurement. But while we may, for certain psychological ends, find it convenient to look at mental processes as existences, we *must* look at them as functions; and this, whether we are 'parallelists' or 'interactionists.' In the former case we have at least to say that the brains which now throw off these and these processes, as the correlate of their physiological functioning, are the brains that have survived in the struggle for existence; mental processes are thus at least indicative of organic function. In the latter we can find no reason for the existence of mental processes, save that they have themselves proved serviceable for organic survival in the course of evolution. The conception of mind as function is thus forced upon us. But function can be measured. If I can just see a black dot on a white ground at a distance of one foot, while my friend still just sees it at a distance of three, then his brightness sensitivity is three times as great as mine. If I remember two-thirds of a mass of visual material, presented under standard conditions, and my friend remembers five-sixteenths, then our visual memories stand to each other in fidelity of reproduction as

32 to 15. If, using all my partial memories, I can recall five arguments of a given total, while my friend remembers eight, then the practical value of his memory is one and three-fifths as great as that of mine. All these cases are cases of measurement; but all are cases of the measurement of mental processes regarded as functions of the organism, not as mere existences. And it is here, in our belief, that the psychological laboratory begins without any question to be of service to the teacher. There is no doubt that we can measure mental function. The instances above given are crude and insufficiently qualified; but their principle is sound. We can measure span and fidelity of memory, quickness and accuracy of apprehension, range and direction of imagination, capacity of sustained attention; we can measure inventiveness, adaptiveness, observing power, cool-headedness, suggestibility, etc., etc. Measurements of all these functions may not have yet been made; they may not be the special functions which are of the chiefest interest just now to experimental psychologists. But such measurements can be made; and, when made, are of primary importance to the teacher.

E. B. T.

Professor Sternberg calls attention in the *Centralblatt für Physiologie* to an earlier article ("Zur Physiologie und Pathologie des Lesens") by Dr. Goldscheider and R. F. Müller, *Zeitschrift für klinische Medizin*, Vol. XXIII, p. 131, that I had not cited in a paper on "Apperception," published in this JOURNAL last April. The *Zeitschrift* was not taken at Cornell, and, although I had seen the title in the bibliographies, made only a half-hearted attempt to obtain it, as neither the subject nor the place of publication indicated that it had a direct bearing upon my problem. The incident is a warning not to overlook anything that promises to have even an indirect connection with the question in hand, provided that question be psychological.

Goldscheider and Müller's investigation grew out of the controversy in the literature of aphasia, as to whether reading was by letters or by word form. His experiments began by determining the number of simple lines that could be seen with an exposure of .01 sec. and traced the increasing number as the elements were arranged in patterns, were formed into letters, and the letters were united into words, and the words into familiar sentences. The influence of meaning was studied by omitting or changing certain letters and noting the way in which the word was completed. In brief, the results showed that reading was both by letters and by word form; that certain letters were of more importance than others, and that memory images and association play an important part in perception. My experiments agree with his in every point.

W. B. PILLSBURY.

THE SIMPLE REACTION.

The following passage from the third edition of Wundt's *Vorlesungen* (p. 316, n.) is of interest in the light of recent discussions of the simple reaction:

"In some [recent] investigations upon reaction-times, the expressions 'sensorial' and 'muscular reaction' have evidently been employed in a sense entirely different from that in which I use them here. In certain cases directions have been given to the sub-

jeet which differ in essential points from those that condition the complete and shortened forms of reation; in others, the choice of the reaction form has been left to his own judgment. This must be the reason that some observers have been unable to find any difference at all between the sensorial and the muscular reaction, while others have recorded differences in the results obtained from different subjects — the sensorial reaction proving to be longer than the muscular, or the muscular longer than the sensorial, or the two of equal length, according to the individual under investigation. At all events, the terms 'sensorial' and 'muscular' reaction have been taken here in a different meaning from that assigned them in the text [p. 316]; and it is further probable that the subjects themselves have varied in their understanding of the directions given. No general statement can be made, however, as to the interpretation of experiments of this kind; the printed accounts of them are too defective. Nothing is said, in particular, of any observance of the criteria of the complete and shortened forms laid down just now [pp. 313 ff.], of attention to the erroneous reactions, the premature reations, the distracting effect of outside stimuli, etc. Indeed, there are some papers which do not tell us even of the mean variation of the separate observations. Now it is quite possible that there exist forms of reaction over and above the complete or 'sensorial' and the shortened or 'muscular' forms, and that some of these may possess psychological interest [cf. p. 313]. But it seems to me that we have as yet no experiments that we can employ for a settlement of this question. Nor do I think that the observations which we have can sustain the conclusion that different individuals show 'typical' differences, which determine the duration and character of their reactions. For it is not improbable that the results which these differences are made to account for are due partly to differences in interpretation of the directions given to the subjects, and partly to habits of experiment, accidentally established and psychologically irrelevant."

PORTRAITS.

I have recently had large, almost life-size platinotypes of Wundt and Fechner made for the Cornell Laboratory by Herr Carl Bel-lach, Gellertstrasse, Leipzig. As the pictures are very good and not expensive, it seems not worth while to call attention to them here. The portrait of Wundt costs mk. 40, that of Fechner, mk. 60. The total expense of the pictures, delivered at the laboratory, was mk. 107 and \$1.50. E. B. T.

The first general meeting of the Childhood Society of Great Britain, founded in 1896, was held in London, Jan. 12, Sir Douglas Galton, the chairman of the society, presiding.

The Open Court Publishing Co., Chicago, Ill., offer a series of thirty-four portraits of psychologists, suitable for framing, at the very moderate price of \$5.00 (better paper \$7.00). Among the psychologists upon their list are Cabanis, Maine de Biran, Beneke, G. E. Müller, E. H. Weber, Fechner, Helmholtz, Hering, Aubert, Maeh, Stumpf, Wernicke, Exner, Munk, Steinhthal, Brentano, Paul Janet, Ribot, Taine, Fouillée, Binet, Bain, Romanes, Ll. Morgan, Bastian, James, Ward, Sully, Stanley Hall, Ladd, Wundt. It may be hoped that Herbart and Lotze will be added.

Dr. W. H. R. Rivers, lecturer in experimental psychology at the University of Cambridge and at University College, London, will accompany the Cambridge expedition to Torres Straits and Borneo. In conjunction with Drs. W. McDougall and C. I. Myers, Dr. Rivers will "test the senses and sensibility of the natives, as far as it will be possible under local conditions, and make whatever observations he can on the mental processes of the natives. Besides the ordinary instruments for anthropometry there will be a small, carefully selected collection of apparatus for experimental psychology. Two mechanical phonographs will be taken to record the native songs, music and languages." Opportunity will thus be given for "studying comparative experimental psychology in the field." The expedition starts at the beginning of March, and returns in the early summer of 1899.

The 1898 meeting of the American Psychological Association will be held in New York. Professor H. Münsterberg is president, and Dr. L. Farrand secretary for the current year.

BOOKS RECEIVED.

- ARRÉAT, LUCIEN. *Les croyances de demain.* F. Alcan, Paris, 1898, pp. 178. Price, frs. 2.50.
- BERTRAND, ALEXIS. *L'Enseignement intégral.* F. Alcan, Paris, 1898, pp. 313. Price, frs. 5.
- CHAPIN, JOHN B. *A Compendium of Insanity.* (Illustrated.) W. B. Saunders, Philadelphia, 1898, pp. 234. Price, \$1.25.
- BINET, A., ET HENRI, V. *La fatigue intellectuelle.* Avec 90 figures et 3 planches hors texte. Schleicher Frères, Editeurs, Paris, 1898, pp. 338.
- LE DANTEC, F. *Evolution individuelle et hérédité. Théorie de la variation quantitative.* F. Alcan, Paris, 1898, pp. 308. Price, frs. 6.
- DUGAS, L. *La timidité. Étude psychologique et morale.* F. Alcan, Paris, 1898, pp. 167. Price, frs. 2.50.
- ISTITUTO PSICHiatrico di REGGIO-ENIDIA. *Lavori originali del laboratorio di psicologia sperimentale (1896-97).* Tipografia di Stefano Calderini e Figlio, Reggio-Enidia, 1897. Anno I, Volume I, pp. irregular.
- JANET, PIERRE. *Néuroses et idées fixes. 1er vol. Etudes expérimentales sur les troubles de la volonté, de l'attention, de la mémoire, sur les émotions, les idées obsédantes et leur traitement (travaux du laboratoire de psychologie de la clinique à la Salpêtrière. Première série).* F. Alcan, Paris, 1898, pp. 492. Price, frs. 12.
- LIPPS, TH. *Raumaesthetik und geometrisch-optische Täuschungen.* J. A. Barth, 1897. Price, mk. 12.00.
- PICK, LEOPOLD. *Die vierte Dimension.* Arwed Strauch, Leipzig, 1898, pp. 46. Mk. 1.00.
- SCRIPTURE, E. W. (Editor.) *Studies from the Yale Psychological Laboratory.* Vol. IV, 1896, pp. 141. Yale Psy. Lab., New Haven, Conn. Price, \$1.
- SIDIS, BORIS. *The Psychology of Suggestion. A research into the subconscious nature of man and society.* With an introduction by Professor William James of Harvard University. D. Appleton & Co., N. Y., 1898, pp. 386. Price, \$1.75.
- TITCHENER, EDWARD BRADFORD. *A Primer of Psychology.* The Macmillan Co., N. Y., 1898, pp. 314. Price, \$1.50.

- WRESCHNER, ARTHUR. Methodologische Beiträge zu Psychophysischen Messungen (auf experimenteller Grundlage). Schriften der Gesells. f. Psychologische Forschung, Heft 2. (iii samm.-lung.) Johann Ambrosius Barth, Leipzig, 1898, pp. 238. Price, mk. 7.
- WUNDT, WILHELM. Die Geometrisch-Optischen Täuschungen. Des XXIV Bandes der Abhandlungen der math.-phys. Classe der Königl. Sachs-Gesells. der Wiss. No. II. Mit 65 Textfiguren. B. G. Teubner, Leipzig, 1898, pp. 178. Price, mk. 5.

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THE INSTITUTIONAL ACTIVITIES OF AMERICAN CHILDREN.

By HENRY D. SHELDON, Fellow, Clark University.

The paper here presented is the outgrowth of an interest kindled by a study of Froebel's "Education of Man." It was undertaken in the hope that it might be able to throw additional light on the pedagogical value of games,—an important educational factor sometimes lost sight of in our modern devotion to the technique of formal instruction. The social activities of childhood have been approached from three lines of attack. An individual biographical study has been carried out at great length. Such a study furnishes opportunities for careful psychological analysis, something impracticable by the remaining methods. Secondly, a topical syllabus covering the most important lines of interest was issued. This supplied material by which the merely local and personal peculiarities of the first study might be checked off; also many of the confessions were of much more frank a nature than those of children. Lastly, the children themselves were appealed to, and, by a series of compositions, an attempt was made to estimate the relative value of the different factors in the child-life of to-day. In addition to the empirical studies a brief survey of some of the leading adult societies for children is included. A brief survey of the literature of the subject is appended. The paper deals only with the period of childhood, or from the years from four to fourteen, although a continuation of the study through the period of adolescence is projected.¹

¹I take this occasion to express my obligations to Dr. G. Stanley Hall for his many suggestions, without which the article in its present form would have been impossible. I am also indebted to the criticism

PART I.

STUDY OF CHILDREN'S COMPOSITIONS.

The best approach to the subject is through a discussion of the results obtained from children's compositions. This section aims to afford a broad, general view of children's spontaneous societies in their quantitative relations. The succeeding sections of the paper will contain an analysis of the results here obtained.

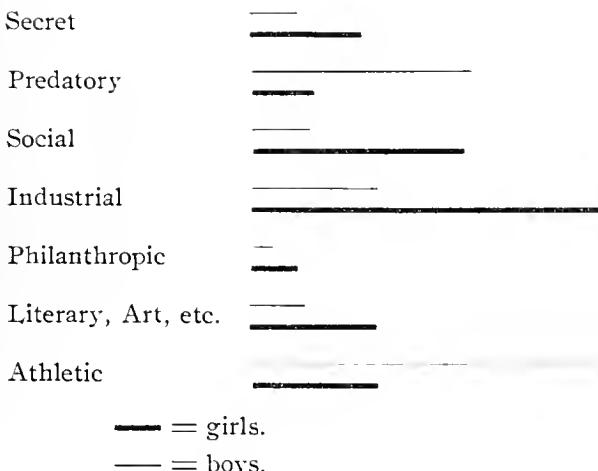
The test given was short and simple in character. The children were directed to write a composition or language exercise on some society or club. The only qualifying condition was that the club should be one which they had organized themselves without adult assistance. The teachers were enjoined from assisting, suggesting or in any manner influencing the pupils. The test was given in all of the grades of the school at the same time, and to prevent communication between the pupils concerning the exercise, it was given unexpectedly. The children were led to believe that the work was for their teachers and had no clue to its true purpose.

Responses were collected from five cities: Manchester, New Hampshire; Chicopee and Springfield, Massachusetts; Stockton and Santa Rosa, California. Thus the two extremities of the country, New England and the Pacific States, are represented and the two extremes of rural and metropolitan life have been avoided. 2,906 children were given the test. Of the returns 398 were defective in certain particulars, in a majority of cases the age of the pupil being omitted, they were in consequence useless for the purposes of the investigation.

of Dr. W. H. Burnham, of Clark University, to Mr. Frederic L. Burk and Prof. Will S. Monroe, of Westfield. Prof. Earl Barnes has furnished valuable material. The statistical study of children's papers was only feasible through the co-operation of Superintendents E. M. Cox, of Santa Rosa, California; J. M. Barr, of Stockton, California; George Winch, of Manchester, New Hampshire; Clarence Brodeur, of Chicopee, Massachusetts, and Miss Fannie B. Gates, of Springfield, Massachusetts. Among those who have sent in valuable responses to the questionnaire are, Mrs. Hattie Mason Willard, of Escondido, California; Prof. Everett Shepherdson, of the Los Angeles State Normal; Prof. Charles J. Bennett, of the San Jose State Normal; Miss Margaret Schallenberger, of Stanford University; Miss Estelle M. Darrah, of the Mankato State Normal School, Mankato, Minnesota; Miss Lillie A. Williams, of the New Jersey State Normal, Trenton; Prof. M. H. Scudder, of New Haven, Connecticut; Prof. Oscar Chrisman, of the Emporia Kansas State Normal, and Miss Alma Patterson, of Riverside, California.

I also desire to thank the secretaries of the various children's societies for their uniformly courteous response to numerous requests for information. I have been especially aided by Dr. William Byrou Forbush, of Winthrop Church, Boston, who has placed his valuable collection of material at my disposal.

CHART SHOWING SEX DIFFERENCES.



Of the remaining 2,508 responses, 810 or 32% signified that they had never belonged to such organizations, although a great majority expressed a willingness to do so if opportunities presented themselves. As would be expected, the proportion without such experience was much higher during the earlier years of childhood.

Although the test called only for the spontaneous organizations of children, in many cases the limitation was disregarded. 641 pupils wrote accounts of organizations in which adult influence was apparent, the great majority of these consisted of church and philanthropic societies. It is worth noting that a distinct sex difference is here shown to exist. While the number of the two sexes writing was approximately equal, 384 girls gave responses of this type as against 257 boys. The tone of the papers differed, the girls being decidedly more enthusiastic than the boys.

Of children's organizations, there remained 1,166. The classification of these was a task of no small difficulty, owing to the lack of clear or definite ideas in the minds of the writers. Some clubs seemed to include almost every line of activity. These, however, were fortunately few in number, and were left to the last, when the collator had his previous experience as a guide. They, however, introduced an unavoidable personal element into the tabulation. Of the 1,166 papers, some 40 might be classed as complex. The remaining papers seemed to fall into the following seven classes:

1. *Secret Clubs.* Under this head were collected all clubs of whatever nature having secret features. While the majority were for the purpose of having a good time, this was by no means universally the case. Clubs to prevent swearing, societies for trout fishing and literary organizations, all had their secret features. The number of secret societies appeared to be much smaller than was anticipated. As will be seen by the accompanying charts, this class of societies remained a fairly constant element during the ten years recorded, and was characterized throughout by a large feminine preponderance.

2. *Predatory Organizations.* These represent the migratory, building and out-of-door instincts, and include bands of robbers, clubs for hunting and fishing, play armies, organized fighting bands between separate districts, schools or sections of a town or city, as well as associations for building houses, forts, etc. Organized games are reserved for a succeeding section. The predatory organization is the typical association of small boys. After twelve years of age boys transfer their interest from these loose, predatory bands, to more definitely constructed athletic clubs. This form of children's organization is peculiar, liable to perversions, which will be dealt with at length in the next section. Reference to the charts shows that predatory organizations belong to boys, and are strongest in the earlier years.

3. *Social Clubs.* They represent that element in childhood which insists on having a good time, and are the most immediate outgrowth of the social instinct. In many cases their promoters frankly confess that their chief object in organizing was to create an excuse for holding parties, picnics and the like. This is one of the favorite girls associations, they outnumbering the boys in the ratio of five to one. It is a fairly constant element during the ten years represented in the study, and forms slightly more than ten per cent. of the total.

4. *Industrial Associations.* This form introduces the element of personal advantage. The most common forms are sewing circles, giving shows, collecting clubs and playing store. This is the strongest of all the girls associations. The ratio is 187 to 59 in their favor, and the type is a uniform factor through childhood. It has often subordinate philanthropic features, as in case of a girl's sewing society, which meets primarily to sew, and then incidentally helps the poor.

5. *Philanthropic Associations.* Here we have two forms. The first consists of societies, the chief object of which is to help other people. This form predominates. Secondly, there are clubs organized for mutual help against such vices as using slang, swearing, smoking and the like. Such organizations are but slightly represented, numbering only 22 girls and 11

TABLE

Showing the growth of children's social interests from 8 to 17. Collated, 2,284; defective, 398; refused to write, 224; grand total, 2,906.

	AGE	8	9	10	11	12	13	14	15	16	17
No. of papers collected		153	78	119	167	199	205	150	104	30	16
		50	67	127	189	208	224	119	96	44	13
No. of societies reported		35	53	95	133	187	173	120	72	38	12
		28	44	118	155	164	188	90	80	34	11
No. not belonging		22	26	38	35	37	33	36	25	25	7
		25	26	31	49	54	49	25	17	14	3
No. reporting more than one		1	2	5	5	10	6	3	0	4	3
		1	1	13	11	11	11	6	5	5	1
No. having secrets		3	5	10	7	18	12	7	3	4	0
		0	0	5	4	3	2	5	3	1	0
No. of predatory societies		4	5	3	0	7	1	1	3	1	0
		4	2	17	31	18	22	(11)	7	1	0
No. social clubs		0	5	5	8	20	22	15	16	11	7
		0	0	1	5	7	5	4	2	2	2
No. industrial organizations		5	10	20	31	54	36	16	9	5	1
		1	2	8	17	11	9	6	2	1	2
No. philanthropic associations		0	1	0	2	4	6	5	5	0	0
		1	0	1	0	4	1	2	1	1	0
No. literary, art and musical clubs . . .		0	1	1	5	8	5	15	7	7	6
		0	0	0	3	2	4	4	5	5	5
No. clubs athletic games		1	1	4	10	8	15	12	5	10	2
		1	1	20	52	61	75	78	49	44	17
No. adult societies for children		20	25	44	56	66	73	40	32	9	2
		14	19	32	41	45	69	20	7	7	0

Lightface figures=boys.
Boldface figures=girls.

boys. For obvious reasons it has been impossible to chart them. While every precaution was taken to exclude from this rubric, all societies to which the slightest suspicion of adult influence was attached, yet, owing to the brevity of some papers, there may have slipped in such clubs without evidence. A reasonable suspicion may be attached to a number of these papers.

6. *Organizations for the Promotion of Literary, Artistic and Musical Training.* As the curve on the chart indicates, this form of organization belongs more properly to adolescence than childhood. It plays a very unimportant part until the age of 15 is reached. Here, as in the two previous classes, the girls lead the boys in the ratio of more than 2 to 1.

7. *Athletic Clubs.* Including general athletic clubs, football, baseball and cycling clubs. This is the strongest of all the forms of organization here presented. It is the boys' association, par excellence, they outnumbering the girls at the ratio of more than 5 to 1. Reference to the curve shows its increasing popularity until the last year is reached, where the small number of papers invalidates the conclusion. The papers show that these clubs, once organized, are more abiding than the previous forms of association, and mean more to the children involved. They are taken more seriously, and bring in the elements of co-operation and subordination to a larger extent. From these facts it would seem that they tend toward a more valuable form of social training.

CONCLUSIONS.

While the present study is not sufficient in itself to justify any generalization or criticism of the prevailing forms of children's organizations in America, it may be well to summarize what appear to the writer to be some of its chief conclusions.

1. American children left to themselves organize. This organizing tendency is rather unevenly distributed and large numbers of children are out of its sweep, but it still exists, and in the smaller cities of the country includes the majority of the children. Whether this tendency is common to childhood in all lands or peculiar to America and the downward reflection of our democratic institutions, is a question only to be answered by the study of large numbers of children elsewhere, the small amount of biographical data collected seems to support the latter hypothesis. A close inspection of the papers, and a correspondence with students of childhood throughout the country, supports Tarde and Baldwin in their view that imitation is the all-important factor in the social process. This conclusion can only be stated tentatively here, but will be enlarged upon in the following section.

2. Girls take much more kindly than boys to societies organized by adults for their improvement ; they also show much stronger altruistic tendencies than boys.

3. Girls are more nearly governed by adult motives in forming their organizations than boys. They organize societies to promote sociability, to advance their interests, to improve themselves and others. Boys are nearer primitive man ; they associate to hunt, fish, roam, fight, and to contest physical superiority with each other.

4. With the exception of clubs for having good times, holding parties, etc., boys and girls are but seldom together in their organizations. This generalization does not apply to the country districts.

5. Secrecy plays but a minor role in the institutional activities of the American child.

PART II.

REMINISCENT PAPERS.

In order to secure a more favorable opportunity for the study of the social instinct genetically, another method of approach was resorted to. A topical questionnaire (No. 16 in the Clark University Series for 1897-98), treating of the more common forms of children's associations was issued with a request that all experience of any value in tracing the idea be included. The syllabus called for as exact details as possible concerning : adult stimulus, duration of the society, methods of choosing leaders, causes of dissolution, and numerous other important details. 453 reminiscences were received in response to this circular.

PERIOD OF IMITATION.

In a majority of the reminiscences, the years of childhood from four to fourteen contain two distinctly marked periods : the first of these stages, lasting in many cases until the age of ten years, may be characterized as the period of free spontaneous imitation of every form of adult institution ; the child responds easily and sympathetically to his environment. He reproduces in his games and miniature associations as exact a copy as possible of the life around him. In the case of one boy, whose life history has been made a special study, the response to external social stimuli at different periods has been most marked. From four to seven placed on a farm, his play time was spent in raking and threshing leaves, in constructing tiny fences and building barns and corrals. At seven, removed to the sea shore, he immediately makes ships and harbors and turns the gutter into a lake. Later, being isolated in the city, surrounded by an adult library he reads history and dreams of

wars and battles; the back yard is covered with fortifications, the dead almond blossoms as they fell from the trees were marshalled into opposing hosts. Boys in groups play in the same manner. The Corbett-Fitzsimmons prize fight was the signal for an outbreak of pugilistic enthusiasm among the boys of the entire country. The present war with Spain has called into existence thousands of military bands among the school boys. Stamp collecting spreads in much the same manner as the latest popular song.

Many cases of direct imitation have been noted in the returns, a few of which are included.

In a New Jersey school the teacher reads an Indian story on Friday afternoon. All the succeeding winter the school played a game, in which the pupils were divided into two tribes of Indians who waged war during the recess.

In Connecticut, bands of robbers and armies were organized "after what some one had read in some book."

Another observer writes: "There was no outside stimulus to the movement, the fights were modeled as nearly to the storming of forts in history as the boys were able to understand."

A teacher reports that having studied the wars of the United States in their classroom, the boys divided themselves into two snowball armies representing the North and the South.

An additional observation reads that boys from eight to ten, who belonged to a band of robbers, "got their ideas from books."

Vast masses of similar testimony might be cited.

PLAYING FAMILY.

To appreciate the full force of the imitative impulse, one must study the daily life of the average child. Perhaps the most common form for very young children and girls is playing house or family. Many observers testify that the reproduction of the one particular family with which the child is best acquainted, is exact even to the most minute details. Scarcely a reminiscence has been received which does not enter into this earliest and most fundamental of the social processes.

A girl of 17 writes of her early childish experience: "We had a mother, father and children. Sometimes two or three families were formed so that we had cousins and aunts. We used to dress up in any clothes we could find and go to see them, and go out riding and walking. We used to get up family gatherings and parties, and have meals just as any family."

Another girl of 18 years observed a little boy of four years and a little girl of three, who always played father and mother, the dolls being their children. The wife can never get her husband to mind the children. He will walk out and say: "Have my dinner ready when I come back." The other day he told her to have beef-

steak. She said : "I can't fry beefsteak ; you'll have to do it yourself." The boy said : "Papas don't fry meat." The little girl responded : "Yes they do, for my papa did one day." The boy finally had to give in and let her cook something else.

PLAYING STORE.

The American child, like his father, seems to devote his best energies to industrial undertakings—the most common form of which is playing store. Of all forms of social amusement this seems to delight children most. "One of the games I delighted in. The most interesting of anything I ever played." These are expressions typical of the attitude of the average American child. This game varies in complexity from the lemonade stand in the front yard to the elaborate industrial machinery of the miniature community immortalized in President Hall's "Story of a Sand Pile." Some typical returns are epitomized as follows :

G., 16. "The play-room was like a little town all by itself. There were paper houses and barns furnished even to the minutest article, and stables filled with animals of every type and grace. The church was a huge wooden clock, which was made to strike just before the services. Our people were conveyed about in carriages, in the toy train or by means of cars made to go back and forth across the room. Our money we made on rainy days. The bills were cut from green paper, the pennies and silver from cardboard. We took great pains and interest to make them as nearly as possible like the actual."

G., 14. "We had a great deal of fun building our store, for we wanted it just like a real one. When we had finished building it we would gather leaves and grass and other things to sell. Then we appointed one of the children for storekeeper, one for bookkeeper, another for errand boy, and one for mother. We were never tired of playing store, and would often keep it up a whole morning."

B., 11. This youth and a friend formed a stamp society, and issued 15 shares. Of these they kept 8, paying for only one, however, and sold the remainder. A flourishing business soon resulted, but the remaining stockholders complained that the promoters had not paid their share. A cash capital was suggested, but as the stamp fad was on the decrease it was thought better to auction off the stock on hand and dissolve the corporation. The auction netted a 60% dividend on two months' work.

PLAYING CHURCH.

The imitation of religious services are not as common as games of the two preceding classes. This is probably due to the fact that the multitude of religious agencies formed exclusively for children, obviate for vast numbers the need of attending regular services. One reminiscence in three, on the average, makes mention of this game. In case of young children it is purely a game, as the following witnesses testify :

B., 5. Gathered the chickens together in the back yard and would preach to them.

G., 16. "When I was about six or seven years old, my sister, my

brother and myself used to hold prayer meetings. We did not have any special object in doing this, but simply thought it a rather grown-up thing to do. The only object I remember in playing prayer meeting, was to see which one of us could best imitate the older people. We also tried to see who could talk the loudest and longest."

G., 18 at 9. "When I went to school we girls used to play prayer meetings. We had gone to Methodist prayer meetings and revivals and observed the earnestness displayed, and we would imitate the proceedings at school, which we thought very amusing."

G., 17 at 7. The children started a prayer meeting, and they used to lead the meeting and pray and sing. The leaders were chosen by the girls and boys. The rough ones had to lead the meetings as well as the good ones. The organization was closely copied after adult prayer meetings. The society lasted for quite a long time, but was finally broken up because the older persons did not think it was right.

The transition from such pure imitations to organizations involving something of individual inventiveness and purpose is easy as the child advances in years. A record of a society involving strongly the latter element comes from the daughter of a missionary in Asia Minor.

G., 16. "We called the society the H. O. A., these letters standing for the words help one another. The purpose of its members was to help one another to be good. Their age varied from eight to twelve. Every week the society met at one of the homes and held a prayer meeting. There was a collection taken, which was given to the poor. The members took turns in conducting the prayer meetings, which were the same in form as ordinary church prayer meetings. All who joined pledged themselves to be as good as possible. If they should forget their promise at any time, and should quarrel or engage in any impiety, that member of the society who should happen to see the deed was expected to remind the wrong doers by saying H. O. A. At the sound of these magic words the sinners were expected to desist from breaking the promise. If not they were liable to be expelled. Our parents knew nothing about it until it was well started."

EXCEPTIONAL CASES OF IMITATION.

The preceding paragraphs outline the most common forms of social imitation of American children, but by no means exhaust the list. Playing school is treated in a paper soon to appear, by Mr. D. E. Phillips. A lonely, or abnormal or particularly imaginative child may imitate anything which comes within the range of his experience or reading. A number of these out-of-the-way imitations have been collected, of which a few samples are given.

A girl of eleven organized the worship of Pallas Athene. There was a deep ravine with a stream of water. In a broad place in the stream, there were two large flat rocks. On the bank a young sycamore grew from an old stump. This was Pallas Athene, and the flat rocks the scene of her worship. (Pallas grew from the head of her father Zeus.)

There was a court consisting of a king, queen and subjects.

There was also a priest who officiated at sacrifices. The king and queen wore golden rod upon their heads and waded in the streams, attended by their subjects, and gathered lovely flowers for Pallas Athene, and caught cray fish, which were duly smashed upon her altar. Sometimes there was a special celebration, when, in addition to the slaughtered cray fish and beautiful flower decorations, and pickles stolen from the dinner table, there would be an elaborate ceremony.

The same girl organized a witch's band, which met at a deserted log cabin, and carried on an elaborate witch ritual. This band, because of its uncanny doings, was intensely disliked by the people in the neighborhood.

A country boy of ten, and much given to reading history, would, when picking up potatoes, throw them in heaps, and would explain to his companions that a certain heap was Athens and another Sparta. When asked why each was so named, he would point to some small physical peculiarity, like a rock for the Acropolis, as a defense of his characterization.

FORM OF ORGANIZATION.

Many of these games have a formal institutional organization. Presidents, secretaries and treasurers are chosen with exceedingly faint ideas of their respective functions. Before the age of ten such officers are chosen simply because children want their societies to appear like those of their parents.

A girl of 16 writes as follows: "When I was about nine years old a secret society was formed in the school. It was called the independent society of young people. We had a treasurer, secretary and president, though we never seemed to think of them as having any special duties."

From a girl of 18: "When they wanted a constitution, they appointed a member to write it for them. This member went home and looked through a chest of papers belonging to her father, until she found an old constitution of an organization to which her father belonged. She copied this constitution, changing some of the words to suit their own little society. Although they had this constitution, they very seldom paid any attention to it. If they wanted to do certain things, they would do it whether the constitution allowed them to or not. The only reason they had a constitution was because they thought they must have one in order to become a society."

CASTE FEELING.

From the evidence at hand, it would seem that the feeling of caste reaches its culminating point of expression about the end of the tenth year. Among very young children, it is almost wholly absent. Girls become acquainted with social, racial and industrial differences through their mothers; boys from their associates. While its expression in the form of bullying and teasing, as might be supposed, is more intensive among

boys, the feeling of exclusiveness and pride appears much stronger in girls. Girls, if so told by their mothers, think themselves too good to play with girls of the working classes or of alien nationalities. Boys, on the contrary, will often run away and disobey parental injunctions to get a chance to play football and baseball with boys of any nationality, Italians, Jews, Irish and even negroes. Although the papers are all from the northern States, negroes are mentioned most often as being victims of caste feeling.

Some examples of individual reactions are presented :

G., 23. Children have an idea that wealthy people are better than poor people, that ministers are superior to others, that American people are superior to foreigners, that colored people are degraded.

G., 18. "I have observed that children distinguish between color and nationality. A few distinguish between the wealth of a person."

G., 18. "I don't think little children have any idea of caste, at least very few; only those who have been taught to have one by their elders. Before they go to school, we see them playing with almost any child, whether of different nationality or race, rich or poor. When they enter school they are not particular in selecting friends."

G., 16. Children almost universally have a distinct idea of despising and taunting those whom they consider below themselves in worldly position.

G., 18. Children think more of their position than when older. They feel the difference between themselves and some other child more strongly.

B., 18. In the Christian Endeavor Society of our town, there were two half colored children. The other children continually teased and taunted these two children.

G., 18. Children generally make color and dress a dividing line in society. I have seen children teasing each other because of race and wealth in numerous cases.

PERIOD OF INVENTION.

During the period from ten to fourteen, associations among children assume a new character. There is less of imitation and play and more of invention and the following of instinct. Children strive less to be like adults. Among boys there is a tendency to form social units characteristic of lower stages of civilization. Bands of robbers, Indians, pirates, the wandering soldier companies of the middle ages, furnish the models of these organizations. Although environment determines the degree of diversion, it is present among boys of every degree of culture. The most marked tendency of this reversion is the falling back on the physical ideals of savagery, and their substitution for the ethical and intellectual ideals of the present civilization. As this is the most important of all the spontaneous organizations of children, a rather full account of two or three such organizations will be inserted.

A number of boys about ten years of age organized an Indian club. The badge of the lodge was a tomahawk. The call was

intended to resemble a war-whoop. "The process of initiation was that they put the subject in a guano sack and jumped him up and down and rolled him over and over on the ground. Another process of theirs was to get the subject to get up on a fence, and the chief had a paddle cut full of round holes, and would hit the subject with it. The society tried to follow the ways of Indian camp, and cooked things over a little fire, and had a tent for a meeting place, and wore feathers in their hats. The chiefs wore feathers down their back."

B. "With a number of chums I belonged to a band of prospective robbers at the age from eleven to thirteen. It was known as the Jesse James gang. It was the time when the James boys figured prominently in the papers, and our gang was modeled after the original as closely as possible. The captain was known as Jesse James until the real Jesse was killed, then he insisted on changing his personality and becoming Frank James. We had different quarters during the continuance of the organization; at one time we occupied the garret of an unoccupied building; at another we established headquarters under an empty house, gaining access by burrowing under the foundation; and still later an artificial cave was begun, but not finished, in the woods. Each member had either a real revolver or an imitation of one. Various other weapons were also displayed. The activities of the band were limited to making raids on empty houses, robbing imaginary banks and the like. No real robbery was ever attempted. There seemed to be a distinct line of demarcation in our estimates of the kind of robbery we were imitating, and real thefts we had been taught were wrong."

B., 23. "I remember belonging to a gang of boys ranging from ten to fourteen years of age. There was no formal organization, but the boy who excelled in the sports was recognized leader. A member had no special qualifications; if he would do what the rest did, he belonged to the gang. A great deal was said about initiation when a new boy appeared in the neighborhood. During the course of a few days the new boy received his 'bumps' several times, besides being put through the paddles and ducked if it were swimming time, and other minor annoyances.

"Often the gang would separate; some of the boys splitting off under the leadership of a rebellious spirit, but eventually consolidating again. If a boy were disagreeable, refused to join in the game or the like, 'he could n't go with us any more.' To us this was a good and sufficient punishment; the offender in every case showed a supreme indifference as whether he went with us or not, but generally returned in a few days. There was great rivalry between our gang and one in another section of the town. No boy could venture into the enemy's territory unless accompanied by a few companions. At nearly every meeting of the two gangs, or sections of them, a stone fight ensued, with the smaller body retreating slowly, with such remarks as: 'Wait till we catch you alone,' or 'Let's get some fellows and go back.' Each gang reigned supreme on its own hunting ground, and successfully repelled all invasions of the enemy.

"I should have said that the gang generally took its name from one of the leaders, one of the wards, or from some feature of the locality, as the 'Rubber Mill Gang,' 'Johnny Jones and them,' etc. In the winter a club was formed by the gang, the only requisite being a club house in which the members assembled, and really suffered a sort of

martyrdom from cold and smoke, although no one had the moral courage to affirm that more comfort was to be had outside.

"As far as I know the gang exists yet, younger members coming into it all the time, and old members occasionally reappearing to watch the youngsters or chat with companions about former days, and fights and what used to be.

"Although, as I have said, there was no formal organization of the crowd spoken of above, I have often felt what an intense loyalty and *esprit de corps* existed among the boys, who, although they quarrelled and fought among themselves, were always ready to assist comrades against members of another gang. And there is great sympathy between former members and the present crowd, which puts me in mind of the feeling between graduates and their Alma Mater."

LEADERSHIP.

As among the North American aborigines, leadership in boys' predatory associations is largely a matter of physical strength and daring. It is, in a vast majority of cases, the boy who can "lick" the other boys, who can throw a stone the farthest, who can ride in the most daring manner, who becomes captain. As the members of the gang are approximately the same age, superior years is an absent factor. Daring sometimes takes the place of physical strength, but the contests are of too primitive a nature to permit intellectual superiority to count for much.

The following are notes from observers :

G., 17. The chiefs on either side were the persons who could run fastest. If they could run fastest, they could take the most scalps, and were therefore the bravest.

B., 20. The best fighter of the boys usually became leader.

B., 19. The toughest boy in each town became leader. They picked out the lad who was strongest and could fight the best.

B., 18. There was no formal organization (of the gang). The best fighter generally took the lead in getting it up, and was recognized as commander.

B., 10. The leader was the one who was the most daring and who could fight any other boy in any other gang.

B., 14. The bravest and most daring always became the leader in these organizations.

B., 15. The leader was the largest and strongest boy in the crowd, and the one that had a great deal of self-confidence and was very daring.

G., 18. The strongest boys were asked to join the fight, and the best fighter was chosen leader. If the boys did not follow the directions of the leader they could not remain in the fort.

MAINTENANCE OF DISCIPLINE.

Preserving order within the gang is a task of no great difficulty. The basis of selection for leadership explains why this is so. The leader is the embodiment of the ideal of the association. In a band which puts a premium on physical powers, he is the strongest. With few exceptions, he has little diffi-

culty in making his authority felt. His treatment of rebels and malcontents is usually summary and effective.

B., 14. What the leader says is law, and if not obeyed immediately the disobedient person is considered an enemy, and is dealt with as such.

B., 18. If any of the boys did not obey they were cuffed over the ears, and sent home until they got over it.

G., 18. If the members did not obey they were bullied by the other boys.

B., 16. If the members would not conform to the rules of the society they were expelled from it, but not before they had received a good beating from the remaining members.

OUTCOME OF PREDATORY ASSOCIATIONS.

However innocent these predatory bands may be among small boys, when the age of twelve is reached and the predatory function remains primary and is not subordinated to the athletic, they become dangerous. The members are no longer satisfied with mere play, and danger is a spice which exerts more and more of a fascination. The robber knight, the pirate chief, and the savage marauder become real models. A few typical instances from a vast mass of testimony are here given:

B., 16. "There was a band of young boys in our city formed for the purposes of stealing. They were between the ages of twelve and sixteen. They formed it to steal all they could get. They stole milk bottles off people's steps early in the morning, rings from the door steps, iron car couplers, fruit and vegetables from the stores, and anything else which they could get. They took these things to a den, as they called it, which was an old vacant barn."

B., 15. "The boys of our town often formed in parties and raided the farmers melon patches. There was no formal organization or election of officers."

B., 18. "At my home a good many boys form clubs. When thus banded they steal boards for election day bonfires. One club called itself the 'Gang.' They have no adult stimulus."

G., 17. Reports a society formed to bother a family in the community who were spiritualists. It lasted as long as the members were boys.

B., 18. "There was no formal organization, but there was a planning how, when, and what they should steal. The objects stolen were not trivial, but valuable objects."

G., 18. "I was in the country last year, and several boys were talking about stealing fruit and vegetables. They planned to stick by each other and meet in the woods, bringing with them all they could find. I think they were going to camp there for the summer, that was why they were going to steal."

Similar cases are continually finding their way into the newspapers and police courts.

The *San Francisco Examiner* of February 28, 1898, contains the report of the examination of Roy Palmer, the leader of an organized gang of boy pilferers, the members of which belong to the first families in the city of Salinas, California.

The lads had banded together for the purpose of entering stores and stealing anything they could lay hands on, selling their loot to other people, and plundering them while so doing. They were well organized, with a president, secretary and treasurer. The money received for stolen goods was used to buy candies, gum and ten cent detective stories. Pistols and cartridges were found in a cache where they had been hidden by the boys.

A similar affair is recorded in the *Boston Herald* of March 19, 1898, as follows: "A gang of youthful marauders, twelve in number, living in Wollaston, has been committing a number of petty thefts in that place. It is alleged that the boys abstracted the signal boxes of the New York, New Haven and Hartford R. R., at Wollaston. Houses were entered by the gang, and electric bells and connections stolen. They also broke into the Golf Club of Wollaston, at Norfolk Downs, and a number of golf sticks and balls were stolen from the lockers.

"There are a dozen boys in the gang whose ages range from 8 to 15 years. This embryo Jesse James gang had built a number of huts in the thickets of the lowlands of Wollaston, where they had hidden their plunder. They had utilized the electrical appliances stolen from the houses mentioned to connect the huts for electrical communication. The members of the youthful gang belong to good families, and the injured parties are disinclined to prosecute the offenders."

In the large cities, such gangs have become not only a nuisance, but a positive danger. A thorough study of their working in New York City has been made by Mr. Jacob R. Riis in his valuable work, "How the Other Half Lives." In a few sentences an attempt will be made to outline the principal points in his treatment of the subject. On the East Side, New York, "Every corner has its gang," not always on the best of terms with its rivals in the next block, but all with a common programme of defiance of law and order, and with a common ambition to get "pinched," *i. e.*, arrested, so as to pose as heroes before their fellows. Individually the New York tough is an arrant coward, it is only when he hunts with a pack that he is dangerous. Then his individual vanity makes him forgetful of all fear or caution in his desire to distinguish himself before his fellows—a result of swallowing all the flash literature and pennydreadfuls that he can borrow, beg or steal—and there is never any lack of them—and of a strangely dramatic element in his nature that is nursed by such a diet into rank and morbid growth.

The gangs have their club rooms, where they meet, generally in a tenement, sometimes under a pier or dump, to carouse, play cards and plan their raids. The gangs, like foxes, have

more than one hole to their dens. In some localities, where the interior of the block is filled with rear tenements, often set off at all sorts of odd angles, surprise alone is practicable. Pursuit through the winding ways and passages is impossible. A tenement once pitched upon by the gang with its ear marks of nightly symposiums, "can rackets," in the language of the streets, is on the road to rapid deterioration. Valuable property is often well nigh ruined by being made such a thoroughfare.

Outrages by the gangs are numerous. Within a single week, one spring, the newspapers recorded six murderous assaults on unoffending people committed by highwaymen on the public streets. How many more were suppressed by the police, who always do their utmost to hush up such outrages in the interests of justice, it is impossible to say. Entire neighborhoods are so terrorized that no one dares to testify against the gang. Occasionally their atrocities are appalling. A young lad, who was the only support of his aged parents, was beaten to death, within a few months, by the Alley Gang, simply for being at work, trying to earn an honest living. The state of affairs here described existed in 1891. At present many of the gangs are unorganized, and the East Side is in a state of quiescence.

In England, there has been of late considerable complaint regarding the depredations of similar gangs. The *London Daily Times* of April 10, 1898, refers to certain cities and towns where numbers of youthful ruffians in their teens band themselves together to commit depredations and assaults, sometimes with pistols, and are a perfect nuisance to their neighborhoods. The passing of the rod and the substitution therefor of juvenile reformatories, imprisonment, fines, etc., is held responsible for this outbreak of hoodlumism. Reinstate whipping seems to be the counsel of many charity experts.

These London gangs are more brutal and daring than the similar organizations of New York. Nearly every district has a gang of its own which terrorize the neighborhood and fight among themselves. Each of these gangs, whose members vary in age from thirteen to twenty years, has its bosses, whose authority is recognized and whose commands are implicitly obeyed. The bosses are not formally elected, but attain their position in virtue of their extra daring and general capacity for command. When war is waged, sanguinary and often fatal conflicts ensue. They are battles in which the combatants fight if not to kill, at least to seriously maim each other. Pistols are quite common; knives equally so, and the members of the gang who are not thus armed content themselves with carrying clubs loaded with lead, iron bars and bits of lead piping. A short time back a little girl was shot dead in one of these encounters; while at last session one young ruffian was sent to

penal servitude for six years, while his companions received shorter terms of imprisonment for grave assault on a police constable.

Like the New York toughs, these youths individually feel the greatest dread of a policeman, as indeed they do of any resolute, able bodied man. But in numbers they apparently dread nobody; and thus it is that the police have a difficult and dangerous task when they have to stop such young ruffians from battering one another about and terrorizing the peaceful members of the community.

To solve the problem which presents itself in these extracts, we must turn to the underlying factors. Both the statistical and reminiscent studies point to the existence of an exceedingly strong tendency in boys to revert to immediate physical reactions, which usually takes the form of contests, to determine athletic superiority. This tendency is so strong as to almost furnish the keynote to his education. Athletic games not only supply the boy with his opportunity for physical training, but with a large part of his social training as well. For the best embodiment of this idea of government through organized athletic games, we must turn to the great English public schools. Perverted, this same tendency or instinct forms the gang or predatory which parents are entirely justified in considering a danger for boys between the ages of 12 and 18. All such organizations truly harmful are the outgrowth of the artificial conditions of the modern city or manufacturing town. The natural modes of expression for the physical reaction instinct, the baseball, football and cycling clubs, are impossible for certain large classes of population in the modern American city. Deprived of the natural outlet, boys and youths revert to the ideals and institutions of savagery. This leads to the discussion of one of the greatest defects in American education to-day, viz., the lack of suitable opportunity for the training of the working classes through athletics. It is, however, the function of the present paper to point out the direction of a solution rather than to attempt to deal with the solution itself.

PART III.

ADULT SOCIETIES FOR CHILDREN.

Within the last thirty years, the social instinct in children has been seized upon as the basis of numerous associations designed to accomplish various adult ends. Of these organizations there are two chief classes. The first may be characterized as the positive or aggressive type. It aims by means of association to inoculate the child's mind with the ethical, social and religious ideas of their parents, their class or their church.

With these ends, modifications of various religious and philanthropic associations have been introduced. Most of the existing organizations are of this type. Recently there has been a change in the point of view, and a second type of children's societies has been produced—the negative. Its object is merely to afford an outlet for the social instinct, and it has no ideals, ethical or otherwise, to inculcate.

Foremost in the new work has been the church. The best representative of the activity of the Protestant denominations has been the Junior and Intermediate branches of the Society of Christian Endeavor. The function of the Junior branch is, in the words of its promoters, "to prepare boys and girls for the active service of Christ." In its main features, it is an adoption of the Senior society; the chief difference being that adult leadership is substituted for self government. The members of the Junior organization take a consecration pledge and possess a working constitution, similar to, though simpler than that of the parent society.

The historian of the Order considers the formation of the Junior societies as the "logical outcome" of the movement. This expression points the way to one of the chief criticisms sometimes passed upon the work, viz., that it is too logical and consistent a copy of the methods of the Senior society. It is said that the organization tends to mechanical imitation. The literature issued from the central office of the society would tend to confirm this view. The plan of campaign minimizes the influence of personality and underestimates the value of leadership in juvenile work. The societies are told that they must not wait for a good leader, but take any one. Experience, however, has shown that the success of these Junior branches is dependent almost exclusively on the personal qualities of the leader. Institutional mechanics are too much emphasized. The Junior departments of the Young Peoples Societies of the other Evangelical Protestant churches, such as the Baptist Young People's Union and the Epworth League are very similar to the Junior Christian Endeavor in organization and methods.

The Roman Catholic church possesses no distinctly children's organization. After confirmation, which usually takes place at the age of 12, the children may be, and in many parishes are, organized into sodalities; this form of organization is, however, by no means confined to children and adolescents. The sodality is governed by a council consisting of a father director, a prefect and two assistants. Among the duties of the members of the sodality are the following: To daily examine their conscience, to recite morning and evening prayers, and to practice the Christian virtues demanded by the duties of their state in life. Once a week the members of the sodality assemble

together and recite in common the little office of the Blessed Virgin Mary (a portion of the ritual to be memorized). Once a month they make their confession and approach holy communion in a body, wearing the badge of the sodalities. Their organization being optional with the priest of each parish, it has been found impossible to collect exact numerical data concerning them.

Another unique form of religious organization for children is that of the boys' branch of the two brotherhoods. One of these, that of St. Andrew, is confined to the Protestant Episcopal church, while the other, dedicated to Andrew and Philip, is interdenominational (Protestant). They differ from the Junior Christian Endeavor and similar societies in being confined to boys. The members are bound by two vows. The rule of prayer requires each brother to pray daily for the advancement of Christ's kingdom among boys. By the rule of service, they pledge themselves to take some part in the work or service of the church and to get other boys to do the same. Both these Orders are distinctively religious in character. Amusements are provided, not for the use of the members, but for the boys they are expected to influence. "They are not a guild or boys' club, but training schools for Christian loyalty. The advantages of the brotherhood idea are two: First, the boys are by themselves; secondly, the element of personal and institutional loyalty; something tangible before the boys and easily comprehended, is insisted upon, rather than ethical principles.

In addition to the church societies there are other organizations based on Christian teaching, but placing the religious element in subordinate position and laying chief stress upon the accomplishment of practical philanthropic work. An excellent example of this sort of institution is the "Ministering Children's League," an international order founded by the Countess of Meath. This society endeavors to accomplish two ends. Primarily it aims to "promote kindness, usefulness, and the habit of usefulness among children." These results are best obtained by giving them some work to do. As a consequence, each member pledges himself "to do at least one kind deed every day." The hand-book of the league emphasizes the gain of immediately attempting some charitable scheme, and directions for making games and packing Christmas boxes are sent to each society. This Order numbers 50,000 members in the United States. The King's Sons, and the children's branch of the Ten Times One is Ten clubs, organized by Edward Everett Hale, carry out a similar programme.

Another class is formed by those organizations which have some one definite social reform in view. Such a society is the

Loyal Temperance Legion, which is under the auspices of the Women's Christian Temperance Union. The members pledge themselves to abstain from alcoholic stimulants and narcotics. The society issues manuals and charts showing the effect of intemperance on the human system. Like the junior branch of the Society of Christian Endeavor, there is a complete institutional organization among the children. In the last five years considerable attention has been devoted to practice in parliamentary law. By its last annual report there were 100,000 members of the legion. The Protestant Episcopal Church, many dioceses of the Roman Catholic Church, and secret temperance societies like the Good Templars, all possess children's organizations devoted to this purpose, and varying in efficiency. Nearly akin to these are the "Bands of Mercy," organized in the common schools for the protection of animals. Their constitution is very simple, consisting of a skeleton of an organization, a pledge and a badge. The Massachusetts Society for the Prevention of Cruelty to Animals, under the leadership of George Angell, has circulated humane literature by the ton through the medium of these Bands of Mercy.

Such is a brief and inadequate sketch of some of the leading forms of adult activity for children found in the country. The movement is assuming large proportions. Children's societies are becoming important weapons of propaganda. At least one child in every three belongs to some such association, and their number and influence are rapidly increasing. From the standpoint of a student of pedagogy what is to be said of their expediency?

An understanding of the subject will be promoted by endeavoring to comprehend the point of view of their promoters. The following justification from one of their oldest exponents, Mrs. Mary Low Dickinson, of the Society of King's Daughters, is inserted for this purpose. In response to the query, shall children early be allowed to become members of religious and philanthropic societies? she writes:

"We would say that any little child is old enough to know that he is sometimes naughty, that he has his little temper and greediness and fretfulness and laziness to struggle with, is old enough to be helped to see those things and be inspired with a desire to overcome them. In other words, the little boy who knows that he is a bad boy and would like to be better, is old enough to be taught that Jesus, his Saviour, is loving and watching and ready to help him to be better, and that he can leave off his naughtiness and try to be good for His sake. One little fellow of four years, on having this explained to him, said quietly that he would have 'to consider it,' and the next day came to his auntie with the statement that he would like to try to be one of the little sons of the King. Whenever his naughty little temper got the better of him thereafter he ran to his mother pulling at his little badge with, 'Take it off quick, mamma, take it off, I am bad.'

"We have all heard of the children who are watching their mothers' faces, and making it their business to let no new wrinkles come; and, without exaggeration, our records contain thousands on thousands of instances in which the selfishness and naughtiness of little children have been overcome by the constant reminder which the little cross was to them, that they must return good for evil, and think and speak no evil of those with whom they had to do."

The question which arises in connection with the instances cited in the above eloquent appeal is: Are these children normal? Are ordinary healthy boys and girls troubled concerning their sins? Have they a passion for altruism? Are they inclined to protect birds and beasts and save their pennies for the pagan children of India or Central Africa? Most of the evidence thus far collected fails to substantiate the position taken by Mrs. Dickinson. Few children's societies organized voluntarily have altruistic features. They are "to have fun," "so we could get together," etc. In response to one of the rubrics of the questionnaire the respondents gave the reasons why, when younger, they enjoyed attending these adult societies for children. In these answers, the music, the picnics, the entertainments, the pleasures of office-holding figured largely, while altruistic reasons were in a small minority, and were limited to girls. It was the universal testimony that such organizations had no charms for the average boy, who seldom attended unless compelled to. This important sex difference, when added to the fact that boys and girls during this period of their lives seldom associate together in their voluntary enterprises, would seem to demand separate treatment and separate organizations for the two sexes.

All the testimony thus far collected bears out the hypothesis that altruism is one of the concomitants of the emotional upheaval of adolescence. It would appear, therefore, that many of the organizations now founded for children rest upon adult ethics and psychology rather than upon any knowledge or study of child nature. Many of these organizations are premature, and when effective produce a growth of hot-house virtues destined soon to disappear. However, their effectiveness is questionable. To a certain slight extent they give the child a social training in manipulating the machinery of organization. But, as a rule, if the responses to the questionnaire are typical, they furnish a meeting place for girls, and to some extent perform the functions of a social club, while boys stay away, or, when compelled to attend, create disturbances which are difficult to deal with.

That this is not a mere academic conclusion is shown by the fact that several groups of the most advanced Christian workers are throwing themselves into the organization of boys' clubs. The Y. M. C. A., which formerly neglected this branch of

their work, are determined at length to put it on an equal footing with other lines of activity. The university settlements have been experimenting with the problem under great difficulty owing to the quality of boys dealt with. Churches and cities are organizing boys' clubs on a sound financial footing. Four lodges for boys, based on what is believed to be a sound analysis of boy character, have been formed. Of these, the Boy's Brigade, a military organization, has attracted the largest share of public attention. Owing to the cost of equipment, the monotony of drill, and the difficulty of securing competent leaders, the organization has but a limited field of usefulness. It has also been objected to with some appearance of reason because of its "jingoistic" tendencies. Another order is that of the "Knights of King Arthur," which aims to perpetuate "our noblest Anglo-Saxon legend." It is a knightly fraternity, not a secret society. Its attractiveness to boys is said to be in its appeal to the love of show and mystery. The Princely Knights of Character Castle and the Coming Men of America, are two secret orders of somewhat similar character. The former has, however, a religious basis, while the latter is purely a business enterprise. All these lodges are increasing their membership with great rapidity. They subject themselves to criticism by the comparatively slight attention they pay to athletics, the strongest interest of boyhood.

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DENDRO-PSYCHOSES.

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To trace one of the relations between mind and its environment backward toward its source is the attempt of this paper. The influence of trees on the life of man is the topic. Why have trees played such an enormous part in the emotional and spiritual life of the race? Why do primitive peoples still worship trees and believe them to be powerful spirits, or the abodes of spirits, which rule the destinies of men? Why have the shrines of early religions been consecrated groves? Why were "the groves God's first temples," and the Garden of Eden a plantation of trees?

Children, too, are lovers of trees and flowers, and bestow on them an amount of attention and even devotion entirely out of proportion to the return they get—judging by our cold scientific standards. Even to-day, among peoples of the most advanced civilization and persons of the highest culture, life-trees are common—planted at the birth of a child, and cared for throughout life by the child, the youth, the man, whose life is believed to be intimately bound up with the life of the tree.

If the use and the beauty of trees are not a sufficient explanation of their influence on our lives, we must seek a reason more internal. If there is nothing in the nature of trees which justifies our thought and feeling toward them, then there must be something in the nature of the mind to justify it. If, for instance, the old belief that trees were spirits were shown by later investigation to be true, there would be nothing strange in the human mind having originally come to that conception. It would be merely a step in the advance of science. On the other hand, when such a notion is found to be entirely inconsistent with science, when the thought finds no justification in the nature of external things, but is none the less entertained by all primitive peoples and not originated by the vagaries of an individual thinker, a reason for its existence must be sought in the mind itself. If present circumstances are not a sufficient reason for present thoughts and feelings, then mind must have been, in some period of its evolution, subject to influences which left an impress that developed into more definite forms of instinct or action. It is not to be expected that any of these can be

traced with certainty to their sources. The path from brute-hood through savagery and barbarism to civilization and culture has been too long and devious to be retraced in thought. But the traveller bears certain marks which indicate the course of his journey, and at some of these we shall take a glance.

There is unquestioned evidence in man's body of his having been, in far-gone ages, a dweller in the trees. We may review briefly the biological facts in support of this.

I.

BIOLOGICAL EVIDENCE.

"Man, with all his noble qualities, with sympathy which feels for the most debased; with benevolence which extends not only to other men, but to the humblest living creature; with his god-like intellect which has penetrated into the movements and constitution of the Solar system;—with all these exalted powers, man still bears in his bodily frame the indelible stamp of his lowly origin."¹

It is not to-day claimed that man is descended from an ape:—at least not from any existing species, nor yet have any fossil remains been discovered which would connect him with any of the present forms. He has marked resemblances to all the four species of anthropoids, but differences also, so prominent that it would be absurd to call man the issue of any one of them. He seems, moreover, to be not much more closely related to one than to another of these species. "The gorilla approaches nearest to man in the structure of the head and foot, the chimpanzee in important structural details in the skull, the orang in the development of the brain, and the gibbon in that of the thorax."² Though none of these is the direct ancestor of the human race, yet evolutionists claim that man and the anthropoid apes did have a common origin. It is the "fundamental law of organic evolution" that ontogenetic development follows the line of phylogenetic,—, "the history of the germ is an epitome of the history of the descent."³ "Every creature that lives climbs up its own genealogical tree before it reaches its mature condition."⁴ Taking, then, any two individuals whose ancestry had diverged in earlier generations, we should expect to find them resembling each other less and less as they grew toward maturity; just as the two species or genera, of which our individuals were respectively represen-

¹ Darwin: *Closing paragraph of Descent of Man.*

² Haeckel: *Evolution of Man.* London, 1879. Vol. II, p. 181.

³ Haeckel: *op. cit.*, Vol. I, p. 6.

⁴ Drummond: *Ascent of Man*, 3rd ed. New York, 1894. p. 72.

tatives, became more and more unlike after separating from the parent stock. At birth the similarities ought to be numerous, since the given individuals were then exhibiting the characteristics of their respective types at a time when these types were not yet widely divergent ; in adult life, on the other hand, these similarities would be fewer, as the individuals now represent the present widely separated types. This is exactly what we find in the case of men and apes. The baby ape is much nearer to the human child than the full-grown ape is to the adult man.¹ Extending the comparison, we can of course say that the adult man is farther from the young ape than the mature ape is from the new-born child, because the line to which man belongs has advanced enormously as compared with the ape, from the time of their common ancestry onward, and consequently the child soon passes the highest stage to which the most intelligent of the quadrupeds has attained.

This relationship may profitably be followed out, so far as it applies to the arboreal life of man's progenitors, and the comparison just made can of course be extended to embryonic life, as the child recapitulates before birth the greater part of the structural development of the vertebrate series. In all the anthropoid apes the arms are longer than the legs,—notably so in the gibbons, who can easily touch the ground with their finger-tips when standing erect. In man, on the contrary, the legs are much longer and larger than the arms. The reason is doubtless because of the relative amounts of work to be done by these members. Man's legs must support the whole weight of his body, and have been developed accordingly, but monkey life being chiefly arboreal, locomotion is largely by means of his hands, and the upper extremities have correspondingly increased in size and strength. But this relation does not hold in the human infant at and before birth ; he shows his closer affinity with the lower species, and his earlier mode of existence. The height of the adult is three and a half times that of the new-born child, with arms in the same proportion, whereas the legs are five times as long as those of the child. The approximation of the human infant to the proportions of the anthropoid is still more strikingly shown by comparing measurements at an earlier period. In a foetus of $8\frac{1}{2}$ inches length the arms are actually longer than the legs, and reach to the knees when the body is erect. At the middle of gestation, therefore, when the proportions most closely resemble those of the anthropoids, the arms grow more rapidly than the body and the legs ; in the latter part of the period the legs again

¹ Vogt : *Die Säugetiere in Wort und Bild*, p. 49.

gain, and at birth are longer than the arms,¹ though not to such an extent as in adult life, which is therefore farther removed than child life from man's nearest allies. In the relative lengths of upper and forearm, also, the infant has not diverged so widely as the adult. Savages show the same relations as children between upper and lower limbs—a relation intermediate between apes and adult Europeans. The forearm of the negro is a little longer actually and relatively than that of the European, and the proportion of arm to leg is greater in the negro.

Not only the length but the strength of the arms at birth is remarkable. The clinging power of infants often surpasses that of adults, and goes to show that our ancestors were tree-dwellers and that the children clung to their mothers whose hands were occupied in climbing from branch to branch. Young apes, as a rule, hang beneath their mothers, holding on by the long hair of their shoulders and sides. Those that failed to do this would tumble to the ground or be left behind and fall a prey to enemies from which the mothers were fleeing. Hence, natural selection would bring about a high degree of this clinging power. Of 60 cases of children, less than one hour old, reported by Dr. L. Robinson,² all but two were able to sustain the whole weight of the body at least 10 sec., 12 of these for one-half minute, and 3 or 4 for nearly 1 min. At the age of four days nearly all could hold themselves suspended for half a minute. This power reached its maximum at two or three weeks of age, when several were able to hang suspended for 1.5 min., two for over 2 min., and one three weeks old for 2 min. 35 sec. One child held its weight for 5 sec., with the left hand alone after letting go with the right. This extraordinary strength is wholly purposeless in infants at the present time, and is all the more remarkable when we reflect that the child is otherwise at this age, and for long afterwards, a mere "sprawling ball of helplessness."

Even the reflex act of grasping an object which touches the palm can be of no value to the child now, except to point to a former period when life itself depended upon it. The child's employment of only its hands in the first stages of creeping, while the feet are dragged behind, points to a predominant hand-use in the trees. The child's tendency, mentioned by Holmes, James, and others, to pick up objects with its mouth when it is creeping and its hands are employed, is believed to be a relic of prehuman ancestry.

In no case during the foregoing experiments did the lower

¹ Huxley: *Anatomy of Vertebrated Animals*, 1881, p. 417.

² Nineteenth Century, Nov., 1891. *Darwinism in the Nursery*.

limbs of the infant hang down and take the attitude of the erect position, but were flexed almost at right angles to the body.

In the use of its hands the baby shows a kinship to tree-climbers. In grasping an object it does not put the thumb on the opposite side, but takes the object between the fingers and palm. Arboreal ancestors in going from bough to bough would strike the branches palm first from above downward, grasping with the fingers.¹ In the species of monkeys which live most exclusively in the trees—the Ateles in America, Colobus in Africa, and Hylobates in Asia—the thumb has atrophied from disuse, and the fingers have grown together, because the whole hand has been used merely as a grasping hook. The feet of sloths, the most arboreal animals in the world, are noticeably hook-like.² It is said that in children the power to extend the hand perfectly straight is frequently not acquired till the age of six or seven, as a result of thousands of years of bough-grasping.

The chimpanzee and the orang, when going on all fours, support themselves usually on the backs of their closed fingers, and rarely on the palms of their hands. They are in a transitional stage from quadrupeds to bipeds. Young children in the same way turn their toes under.

Evolution in man's hand has taken place in two ways: by increasing the mobility of the thumb and fingers and their power of independent and varied action, so necessary in delicate work; and by reducing the number and the strength of the muscles used in prolonged grasping. A special flexor muscle for the thumb has been split off from the fibres of the deep flexor that bends the terminal joints of the fingers; in most apes and in some men these two form a single muscle. Along with this appearance of a new muscle is the disappearance of another, the *palmaris longus*, which was an important aid in climbing, keeping the fingers together without independence of action.³ In negroes neither of these changes is so fully carried out as in Caucasian races. The power of independent toe-movement in children, and the wide separation of the great toe from the others, are also evidences of Simian relationship, and point to a period when the feet were used more for picking up objects, and the hands for supporting the body. These characteristics were afterward lost because not needed in most civilized shoe-wearing races, where toes are

¹ Buckman: *Babies and Monkeys*. Nineteenth Century, Nov., 1894.

² Darwin: *Descent*. New York, 1878. p. 51.

³ Baker: *Address in Proc. Amer. Assoc. for Adv. of Sci.*, 1890, p. 351.

becoming rudimentary and are often found grown together. But many bare-footed peoples make skillful use of their toes. By the help of their very mobile toes Chinese boatmen are said to be able to pull an oar, Bengal artisans to weave, and the Carajas to steal fish-hooks.¹ Nubian horsemen hold the rein between their toes. Many lower races—Negroes, Malays, Polynesians, and American Indians—grasp the branches of trees with their toes when climbing, and Büchner says the natives of New Guinea are able to climb from branch to branch without the use of their hands.² New-born children of even the highest races can hold an object as firmly with the great toe as with the hand.³ The bottom of a young child's foot, when the toes are bent downward, shows deep creases corresponding to the lines of the hand. The most marked of these is where the chief folding-in of the skin would take place when the toes were habitually clasped around an object such as a branch.⁴ This cannot be explained as being of any use to the child, as it disappears when the foot begins to be used for locomotion and is scarcely visible in adults, even when the toes are flexed to the utmost.⁵ Such a change from hand to foot is not found in other animals, whose phylogenetic history has not included the use of the foot as a prehensile organ.

An infant's foot is much flatter than an adult's. The arch of the instep, which is necessary to steadiness and ease of locomotion, is not yet attained. The negro, too, has such a foot, which further resembles the monkey's in being longer than the European's.

Infants' feet are very noticeably turned inward. This is even more marked in the embryo, but disappears soon after the child learns to walk. In the quadrumania the feet are similarly turned inward as a convenience in grasping branches.⁶ Thus, what is normal in the fully developed lower species, is also normal in the embryonic stages of the higher, but would be abnormal if found in the mature form. Many pathological conditions instead of being freaks of nature, are simply cases of arrested development, representing structures or functions which are perfectly natural in a lower species.

Even in walking, the outside edges of the ape's feet are used,

¹ Hurley: *Man's Place in Nature*. New York, 1883. p. 104.

² *Position of Man in Nature*. For authentic statements of the delicate manipulation of which the toes are capable through training, see Virchow's *Beiträge zur Kenntniss der Bewegungen des Menschen*, Würzburg, 1883.

³ Haeckel: *op. cit.*, Vol. II, p. 170.

⁴ Robinson: *The Meaning of a Baby's Foot-Print*. Nineteenth Century, May, 1892, p. 795.

⁵ *Ibid.*

⁶ Romanes: *Darwin and After Darwin*. 1892. Vol. I, pp. 77-8.

and bowleggedness is very apparent, as also in the child just beginning to walk. This position of the foot is inconvenient for locomotion, however advantageous for prehension, and has undergone gradual modification as man has attained the erect posture, the large toe losing its independent action and its grasping power, and the sole of the foot becoming horizontal, with an arched instep. Along with this, other correlative changes have been brought about—the vertebral column has acquired its double curvature, giving it more elasticity and preventing jar to the whole frame, and especially to the head; the thorax and pelvis have been modified in shape; and the calves have been greatly developed by the additional work thus required of them. Huxley, quoting from an old English account,¹ tells of a species of ape, the Pongo, that “ differeth not from a man but in his legs, for they have no calfe. Hee goeth alwaies upon his legs, and carrieth his hands clasped in the nape of his necke when he goeth upou the ground [which is interesting, as probably helping to bring about the double spinal curvature]. They sleepe in the trees and build shelters from the raine.” The thin legs and large arms of the Payaguas Indians are attributed to the fact that many generations of them have passed almost their whole lives in canoes, with no work and little movement for their legs. An almost total absence of calves is a characteristic of many primitive races, especially of African and Australian blacks,² and is adduced in evidence of their nearness to ape-like ancestry.

The upright position, relieving the hands from any part in locomotion and leaving them free for the use of tools, has no doubt in large measure been the means of giving man “ dominion over every living thing that moveth upon the earth,” and in a real sense his “ heaven-erected face ” has brought the possibility of a moral nature and the promise of ever-ascending ideals.

The erect posture has been brought about chiefly perhaps through curiosity. When the gorilla wishes to see more distinctly the approaching hunter he rises to the upright position.³ Monkeys and rabbits also stand erect to look at distant objects. “ How recent this change is [in man], how new the attitude still is to him, is seen from the simple fact that even yet he has not attained the power of retaining the erect position long. Most men sit down when they can, and so unnatural is the standing position, so unstable the equilibrium, that when slight-

¹ Purchas his Pilgrimes, 1625. Quoted also by Büchner in his *Man in the Past, Present and Future*. London, 1872.

² Wallace: *Australasia*. London, 1880, 2nd ed., p. 86. Hartman, *Anthropoid Apes*. New York, 1886. p. 102.

³ Winwood Reade: *African Sketch Book*, Vol. I, p. 151.

ly sick or faint, man cannot stand at all."¹ A further evidence of the comparative recency of attaining the erect attitude is the fact that children must *learn* to walk, while animals are able to do this at once. Children, however, make the alternate movements of the legs, necessary for walking, long before such a movement is of any service. It is the bipedal balancing which must be learned with such difficulty. The arms of a child, too, make alternate movements when the palms are gently stimulated. That is to say, both arms and legs inherit, from a million years of such employment, the necessary movements for quadrupedal locomotion, but the additional adjustments required in the upright position have not yet become instinctive, in the few thousand years of practice.

The higher apes' dread of water and the loss of their ability to swim are no doubt the result of their life being exclusively arboreal.

The disposition of hair on the arms furnishes undeniable evidence of arboreal life. The rudimentary hair of the arm from wrist to elbow points upward, and from elbow to shoulder downward. This occurs only in man and in anthropoid apes and some American monkeys. Wallace has observed that the orang, sitting in trees, places its hands above its head with the elbows pointing downward, the hair then serving as a thatch to the rain. Livingstone relates of the gorilla this same habit of sitting "in pelting rain with his hands over his head." This acquired characteristic in man is no longer serviceable, but being in no way detrimental it is not eliminated by natural selection.

Another evidence of man's descent, furnished by embryology, is the lanugo or covering of somewhat long dark hair found on the fetus about the sixth month. It extends over the whole body, except the soles and the palms—which are also bare in the quadrumanæ—but is usually lost before birth, serving therefore no present purpose. It is frequently quite different in color from the later permanent hairy covering. At this stage the human skeleton approaches most nearly to the Simian type. Idiots, who resemble the lower species of primates, mentally and physically, are often much more hairy than normal persons.² Many of the higher apes resemble man in the disposition of hair on their bodies. In most of the higher Old World apes the face is nearly or quite bare, while the hair on the back of the head is usually long. On the outer sides of the limbs it is much more abundant than on the inner, which is paralleled by the fact that not unfrequently, according to Haeckel, men of

¹ Drummond: *loc. cit.*, p. 194.

² Darwin: *Descent*, p. 601.

Semitic race have the shoulders, back, and outer sides of the limbs abundantly covered with hair. African races also are disposed to be hairy.¹

The flat noses of babies, with the breadth across the nostrils equal to the length of the nose, and the pouch-like cheeks, which are retained later, though not required in the human species for storing away food, as when hands were required for climbing, have been regarded as vestiges of lower types of animal.²

Savage peoples ought to show, both in physical structure and mental endowment, a closer correlation with man's nearest allies than is found in civilized races. Some instances of this have already been given: as in the relative length of arms and legs, the greater strength of the arms, the absence of calves. Along this line of evidence there are other facts to be adduced, anatomical, physiological and psychological.

The spinal curvature is increasing. In the Simian the lumbar curvature is backward, in the European it is forward. Even in negroes the collective measurement of the posterior faces of the five lumbars is greater than the anterior (106 to 100); in the white, the anterior faces exceed the posterior (100 to 96).³ The humeral torsion is also increasing. In the stone age it was 152°; in the modern European it is 164°. The humerus was formerly set so that the hollow of the elbow looked inward rather than forward; and as the functions of the arm became more various the lower end of the bone twisted outward around the long axis. By this means the palm of the hand was turned to the front and adapted to a wider usefulness. Not only does this torsion become greater as civilization advances, but there is a difference even between the right and left arm,⁴ as a result of generations of righthandedness. As a further result of the increased use of the hands, the scapula has widened to give a more extended attachment for the muscles used in movements of hand and arm. The scapular index (ratio of breadth to length) is highest among white races, less in infants, negroes, and Australians, and still less in anthropoid apes.⁵

The great toe of the Annamese, which projects at a wide angle from the foot, is mentioned contemptuously by the Chinese 2285 B. C., the race being called the "cross-toes." The atrophy of the little toe is evident by comparing shoe-wearing races with the bare-footed and with children, whose toes run much

¹ Johnston: *The River Congo*, 3rd ed., 1884, p. 414.

² Buckman: *loc. cit.*

³ Osborn: *Present Problems in Evol. and Hered.* Smithsonian Report, 1892, p. 313.

⁴ Baker: *loc. cit.*

⁵ Baker: *ibid.*

more squarely across. Pfitzner¹ finds that the little toe is losing a phalanx, the two end-joints in the skeleton being fused in 41.5% of women and 31% of men. The progressive divergence of the form of the female pelvis from the male in higher races, is shown by the fact that it becomes increasingly difficult in lower races to distinguish the female skeleton from the male. The relatively large female pelvis would for perfectly obvious reasons be preserved by natural selection.

II.

PSYCHIC REVERBERATIONS.

When we pass from the physiological to the mental the evidence cannot be so definite. At best it cannot amount to certainty, but only to probability. There are no psychic rudimentary organs to be studied on the dissecting table, and no fossil remains of mind embedded in the rocks of the Miocene and Pliocene periods. There are products, to be sure, of mental activity to be found in the earliest implements of the rude stone age, but the inference from material products to mental processes is vague and uncertain. Savages are scarcely to be found who are still in the palæolithic age, and even if they were, that would be an enormous advance on the intellectual existence accompanying tree-life. Farther back than these material witnesses to man's advancement, and the evidence furnished by present primitive races, we cannot go. Doubtless a previous age of wooden implements and instruments existed, the beginning of which is shown by the apes who use a club or a branch of a tree as a weapon, but the lack of durability in such material has left us no evidence; and man himself, for ages after emerging from such a condition, could leave no record in chronicle or tradition.

Furthermore, though the child may recapitulate in some degree the mental evolution of the race, the interpretation of the child's mental states is extremely difficult and unsatisfactory. We cannot project ourselves into the child's consciousness. We can only interpret the manifestations of his mental life by employing the adult mind as a standard, and our conclusions are more and more untrustworthy according as the intelligence to be studied is farther removed from the standard of measurement. There is even a further chance of error: our standard—the mature mind—is itself an abstraction, reached by inference, using our individual mind as the primary standard. We must judge others by ourselves; there is no other way open.

But in spite of the disadvantages of the method, and the con-

¹ *Nature*, Vol. XLII, p. 301.

sequent uncertainty of the results, some conclusions of reasonable validity can perhaps be reached. In the customs of savage tribes, in the traditions of barbarous peoples, in the myths of civilized nations, there are survivals from a dateless age, which give us glimpses of the intellectual condition of man, while as yet he was only emerging from brutishhood.

Leaving aside the folk-lore and the social and religious institutions of man, the present section attempts to point out certain vestigial remains in the mind, and ventures to suggest, as the most probable explanation, a long-since deserted home in the trees. "Do we not," says Dr. Hall, "dishonor the soul by thinking it less complex or less freighted with mementos of its earlier stages of development than the body?"¹

Structures and functions change in compliance with a changed environment, or accidental variations arise and find themselves more in harmony with the surroundings. These, therefore, persist and widen; appearing in individuals, they soon become the characteristic of varieties, species or genera. Thus what was at first merely a chance variation, or a modification through environment, by either an intelligent or an unconscious adjustment of the organism, becomes stable in the race by transmission, that is, becomes an instinct. As we progress up the animal scale more instincts are called into being, as the environment becomes more complex—the growing complexity demanding new adaptations. Among higher species conscious adjustment probably plays a much larger part in the origin of particular instincts, and blind natural selection a smaller part.

The decay of instinct, on such a theory, would of course be brought about by a change of surroundings which would call for a modification of some of the life-habits of the species, and the reverse process would be by the same means in general—not necessarily in each instance—as were employed in originating and perfecting the instinct; namely, natural selection and conscious or unconscious adjustment. If in the new circumstances any given instinct were harmful to the well-being of the race, the non-survival of the unfit would soon result, unless a change in the organism could be effected which would bring it into harmony with the new conditions. An obvious exception to this, of course, would be the case in which a structure, whose function had become useless or detrimental, was enabled to maintain or regain its place of honor among the other members of the organism by exchanging its old functions for a new and useful one. But provided the old instinct under the new

¹ *A Study of Fears: AMERICAN JOURNAL OF PSYCHOLOGY, Vol. VIII, p. 147.*

conditions were merely useless, not harmful, and wasted none of the energy of the body which would have been available for other purposes, it would not then be eliminated by natural selection, and might remain for thousands of generations before becoming completely atrophied. So long as vestiges of it remained, we might hope to awaken them into activity by re-inducing the conditions under which the instinct was formerly active. This is scarcely open to direct experiment, but nature in some degree reproduces for us these conditions in the organism, though very rarely in the environment. Such opportunity for observation is given us in children, savages, pathological cases, and in normal adults under conditions in which the higher faculties are not exercising due control, as in sleep. There are cases, even, as in unreasoning and entirely baseless fears, where the exercise of our strongest will is unable to cope with the strength of the instinct.

In the child the higher centers are not yet called into activity. Mentally he is the equal at about fifteen months of the mature ape,¹ and might be expected to show some of its characteristics, and the more so as the environment tended to call forth such reflexes, and the child's strength were equal to the task of responding. The same would be true of savages, without the limiting condition of physical strength, if any could be found so low intellectually as to approach the apes. In certain pathological cases a similar result is reached by an opposite process. Instead of the brain and the mind being built up only to a certain level—using "level" somewhat figuratively, since the intellectually higher and lower in function correspond only roughly to the literally higher and lower in structure—the higher centers have been broken down until the given level is reached. This destructive process follows the law of regression—the reverse of the constructive process. The last to be acquired is the first to be lost. The higher the development the greater is the danger of reversion, as complex products are more unstable than simple ones. Now, instincts which have been active for many generations have become deeply rooted in the very constitution of mind, and although they may have fallen into disuse, or been overgrown and buried so deeply that their very presence is unsuspected, yet when disease has swept away the higher levels, and attacks these, they once more regain their functioning and assert their power, and we get a condition of things similar to that of organisms which have only reached this point in their upward journey. Many idiots are cases of arrested development; senile dementia and diseases which affect the brain present instances of the breaking-down

¹ See Romanes' chart in his volumes on Mental Evolution.

process. A good illustration of this law of reversion is found in people who emigrate to a foreign land in childhood or early youth, and use the language of the new country the rest of their lives, to the utter forgetfulness of their native tongue, but who revert to their earliest speech on their deathbeds. In patients who have been for years insane, a fever will sometimes restore sanity, and during this restoration there will be a perfect memory of things happening before insanity came.¹ That is, the later-formed strata, the deranged centers, are broken down by the attack, and the earlier normal formations are reached, whose functioning brings a restoration to former conditions. We have only to carry the process a little farther down to reach brain levels which represent ancestral modifications. The possibility of such centers being present but inactive is seen from the fact that certain normal instincts do not come into action till maturity. Along with them often appear other mental characteristics which are directly hereditary. At puberty, for instance, peculiarities of thought or feeling directly traceable to forefathers, are frequently developed. Finally, in dreams the will is dormant, the highest centers are, as a rule, inactive, but the lowest brain levels, with the spinal cord and the nerves, only slightly relax their functions, and many reflex acts, therefore, take place. The parts of the brain which distinguish man from the lower animals are much more likely to be inactive during sleep. In sleep, therefore, the tendency is stronger to show atavistic characteristics, both in our attitudes and in our dreams. The visceral and other functions intrude on thought in our waking hours, but their presence on the threshold is, for the most part, disregarded, because our mental reception room is too constantly crowded with guests of a higher caste; but when these have all retired, and consciousness seeks rest, the less honored visitors enter unbidden.

The remainder of the chapter will be devoted to giving examples illustrative of these principles.

Of certain instincts and emotions, then, which serve no present purpose, we must seek an explanation far back when conditions of life differed widely from those of to-day, and when the struggle for existence involved fewer of the elements of higher civilization. An instinctive fear of wild animals, or what has less present justification, the fear of reptiles, may well have arisen, through natural selection, at a time when safety, and even life, depended on flight. Monkeys are known to have a great horror of snakes. The serpent, better than almost any other enemy, can follow an animal up a tree, and attack its

¹ Forbes Winslow: *Obscure Diseases of the Brain and Disorders of the Mind.* 4th ed., 1868, p. 59.

young. From some such enmity and struggle for life, lasting many generations, must have arisen our unfounded fears of the snake.

The percentage of these fears of reptiles, though standing second in Dr. Hall's classified list, is yet exceeded by the fear of thunder and lightning, the frequency of which is out of all proportion to the actual danger. We must therefore seek elsewhere than in present conditions for the rise of this fear; and may it not be that it dates back to tree-dwellers, who would be much more exposed to such a danger? Lightning, as is well known, is much more liable to strike a tree, than an open plain, on account of the former being a better electrical conductor than the air, and having a tipped summit. This danger would still persist through the extended period of man's descent from the trees, and as long as the species had the habit of huddling together beneath the branches as a protection from the storm. It is said that children and savages fear the thunder rather than the lightning, but this of course in no degree affects the argument, inasmuch as it is the thunder which is believed by the primitive mind to be the destroying force.

The fear of high winds which is very common even in districts never visited by tornadoes, may also be explained by the added danger, to tree-natives, of such winds as uproot or dismember the trees. This continuous open-air life would be much subject to other atmospheric influences, and the psychic effects of the weather would be very marked. The constant change of temperature and variations of moisture would be all-important factors in man's physical well-being, and would leave a lasting impress on the constitution of his mind. Is this why the weather has come to be the never-neglected topic of conversation among all races?

The fear of falling is instinctive, as it is found in children who have had no individual experience to justify it. If an infant be dangled up and down on the arms, it will be at rest while being raised, but when descending its struggles will show a sense of danger. Such fears of falling (barophobia), as well as the child's "monkey-like propensity to climb everything, everywhere," may be reverberations from different stages of a life in which climbing and falling were daily experiences.

The fear of strangers, instinctive in children at a certain age, has no reason in the present nature of things, as the children have received only kindness from every one. Such a fear must therefore have survived from the time when it brought safety,¹ when every man's hand was against his

¹ Robinson : *Darwinism in the Nursery.*

neighbor. To the same origin is attributed the game of hide-and-seek, so common, so instinctive one might say, among children, they take to it with such readiness without teaching, when only just able to walk. Hiding behind a chair or curtain, and pretending to be greatly alarmed when discovered, is only making play out of the formerly serious business of life, the furniture of the nursery being substituted for the trunk of a tree behind which the body would be hidden, the eyes protruding for a momentary glance at the enemy, and then quickly withdrawn again.¹ The instinctive holding of the breath when the seeker comes near may have been purposive, the breath otherwise being sufficient to betray the hider's position. The play of animals is very often mimic war, and the games of children are not unfrequently mere relics of religious ceremonies, social customs, or habits of life, whose significance has long since departed.

Fear in the woods is not entirely accounted for by the possibility of present danger, for even adults have traces of such timidity when they know there is absolutely no danger near. Schneider suggests that this is a relic of the period of savagery when darkness and forests were inseparably associated with danger. Darwin had already attributed his child's fear of large animals to the hereditary effects of the real danger of savage life. Agoraphobia, too, probably had its origin when safety depended upon keeping hidden, and running across open spaces was an exposure to be avoided.

The sleep of children shows physiological tendencies which suggest certain ancestral modes of life. Young children when left to themselves will naturally go to sleep on their stomachs, with their limbs curled under them, or often using one arm as a pillow, which is exactly the position adopted by orangs and chimpanzees. West Indian mothers and nurses lay children down in this way. Some savage tribes sleep with the head bent down upon the knees, just as monkeys do.²

Putting babies to sleep by rocking is probably taking advantage of a rhythm which has become ingrained through long ages of swaying in the branches of trees, which would be the natural accompaniment of sleep, with creatures of arboreal habits.³ Rhythmic movements of even short duration leave their imprint on the organism. Sailors after long voyages are unable to sleep well on land, having become accustomed to the rocking of the vessel. Even a landsman, after a voyage of only a few hours will have for some time afterward a feeling of

¹ *Ibid.*

² Robinson: *19th Cent.*, Nov., 1891.

³ Buckman: *loc. cit.*

swaying to and fro when sitting or lying down. The rhythm of walking is often kept up by soldiers on the march when asleep, and therefore entirely without conscious supervision. Plants as well as animals are susceptible to impressions from rhythmic influences. Francis Darwin and Miss Pertz have shown that a plant will continue a rhythmic movement which it has been compelled to obey for a short time, and will curve against gravity though itself a geotropic plant. Heliotropic plants curved away from the sunlight for two half-hourly intervals, separated by one of curvature toward the light, so strongly in a short time had the artificially-induced rhythm been impressed upon them. We may therefore fairly conclude that children, or even adults, will still show traces of rhythms which played upon the organism for perhaps thousands of generations. Evidence is furnished by the regular swaying back and forth of children when standing long, and the similar movements of imbeciles, in both of whom the higher centers are not active for the inhibition of such useless movements.

May it not be that even adult methods of inducing sleep are effective because of this racially-ingrained connection between rhythmic movement and the fading of consciousness—such methods, for example, as counting, watching the long line of imaginary sheep skip over the bars single file, listening to falling drops of water, or imagining one's self rocking on the bosom of a lake? One might even go farther and say that the somnolent effect of all monotony of either thought or feeling is, if not induced, at least strengthened, by thousands of years of swaying in the trees. It has been suggested that the most common of all our nursery ditties, the

Rock-a-bye baby in the tree top, etc.,

and the somewhat similar German

Schlafe, schlaf ein, mein Kind !
Horch ! da draussen der Wind,
Wie das Vöglein im grünen Baum
Wieg er auch dich in Süssem Traum

—that these bear evidence of some lingering traditions of a race of tree-dwellers.

The Lithuanian boy Joseph, who was found among the bears and had animal desires and appetites fully developed, in going to sleep always squatted in a ball and rocked himself.

Darwin gives cases of hereditary habits shown in sleep. Quoting from Galton he tells of a gentleman who had the trick of raising his right arm slowly in front of his face and then dropping it with a jerk across the bridge of his nose. This happened only when he was sleeping soundly. His son had the same habit, and passed it on to a daughter of the third

generation. Ribot speaks of a man who was in the habit of going to sleep with the right leg crossed over the left, and one of his daughters constantly assumed that posture in the cradle. In this way ancestral experiences may bring about certain tendencies in the nervous constitution, which will be manifested, though entirely useless, whenever the conditions are reinstated which originally gave rise to such movements.

The climbing instinct of boys—which indeed is shown by girls too at the age when they are not troubled by oversensitivity—has been regarded by Darwin as a relic of former habit. The baby shows this also in a remarkable degree in his “insane desire to climb up-stairs.” The purposeless spontaneous movements of infants are probably rudimentary traces of functions which were once of importance.¹ The restlessness of children, which gives them so much pleasure in mere movement, may also be an inheritance from the days when it was impossible to be still.²

Suggestibility, which shows little conscious control, and is therefore indicative of a low degree of mentality, is remarkably strong in monkeys and children, in lowest primitive man, congenital idiots and hysterical subjects. In a child of six months there is no such thing as mental inhibition present. The beginnings of it appear at one year of age. But during all the earlier years the inhibitory centers are not fully developed, hence the tendency to imitation is very persistent. In certain diseases this imitation gets to be a mania; in latah the patient repeats everything said and done in his presence, and while knowing the absurdity, or even the immodesty, of his actions, is entirely unable to inhibit the movements.³ The imitative ness of the monkey is equalled by some of the lowest savages. Among the Lapps Hugstrom found individuals who imitated every movement of those who talked to them, as well as the expression of the face.⁴ The medicine-men and sorcerers among primitive people assume many ape-like attitudes, in the mental excitement of their contortions and dances. Relieved from the inhibitions normally imposed by the intellectual operations accompanying the functioning of higher brain centers, the lower centers, representing more racial and earlier-acquired instincts, have fuller sway, and the actions illustrate reverersions to earlier types.

The stories told of children who have been lost or have wandered away into the woods, and have lived there for years in

¹ Mumford: *Survival Movements of Human Infancy*, Brain, Autumn, 1897.

² Buckman: *loc. cit.*

³ Marie de Manacéïne: *Sleep*, p. 120.

⁴ Manacéïne: *op. cit.*, p. 119.

companionship with animals, are for the most part unreliable, but when well sifted still leave an authentic residuum. Such persons show reverions to types much farther back than primitive man. They are expert climbers, usually run on all fours, and can only be taught, after much effort, to assume the upright position. They lap water with the tongue, and have a remarkably developed sense of smell, but are entirely destitute of feelings of modesty.¹

In idiots the higher volitional functions are absent, and their restraining hand—which is heavy upon all of us, but unfelt because of its continual presence—is lifted from these unfortunates, and they often show by action and expression a forcible likeness to apes. The most hopeless cases, which have much less intelligence than apes, show such atavistic characteristics as the vacant stare, gluttonous appetite, thick everted lips, ill-formed large ears, fingers long and slender.² Attentiu, judgment, foresight, will, are entirely wanting. Those, however, which show a less degree of idiocy are usually active, alert, mischievous, imitative, intractable. When no effort is made to educate them, their muscular activity, in the necessity of finding an outlet, often makes them little demons.³ Sollier tells of a boy of ten who has never walked normally, but who climbs into trees.⁴ Clouston describes a girl who has from childhood beaten her head with her hands as the gorillas beat their breast. She kneels down and laps water with her tongue. Her face is beast-like in its appearance, and she lacks even a rudimentary sense of decency.⁵ Krause speaks of the ape-like boy, observed by him, as being very supple and fond of climbing, and having great strength in his hands and arms. His hands had a horny appearance, like those of a chimpanzee. His walk was unsteady, the great toes of both feet being at an angle to the foot. He often stamped his feet and clapped his hands, making a grunting noise like a gorilla. His imitative tendency was especially marked, and all his movements strongly resembled those of apes.⁶ Hartman also observed a semi-idiotic boy, whose shuffling gait, gurgling voice unable to utter words, and habit of striking with his closed fingers on

¹ See Ireland, *On Idiocy and Insanity*, London, 1877; Rauber, *Homo sapiens ferus*, Leipzig, 1888; von der Linde, *Kaspar Hauser*, Wiesbaden, 1887; Tylor, *Wild Men and Beast-Children*, Anthropological Review, 1863, p. 21, etc.

² Bucknill and Tuke: *Manual of Psych. Med.* London, 1879.

³ Clouston: *Mental Diseases*. London, 2nd ed., p. 285.

⁴ *Psychologie de l'Idiot et de l'Imbécile*. Paris, 1891. p. 89.

⁵ Clouston: *op. cit.*, p. 283.

⁶ *Correspondenzblatt der deutschen Anthropologischen Gesellschaft*, 1878, p. 133. Quoted by Hartman.

the ground, gave him a marked resemblance to apes.¹ In other cases, of course, such resemblances are very slight, although microcephalous idiots are, as a rule, strong and active, continually gamboling, and fond of climbing up furniture and stairways.

The male criminal type, which represents the normal in a primitive age, constantly reproduces the psychic characteristics of savages—want of foresight, inaptitude for sustained labor, and love of orgy. Like the lower human races, too, the criminal presents far more abnormalities of anatomy than the average European.² In woman the natural form of retrogression is not crime, but impurity, and in the professionally unchaste the moral reversion is accompanied by physical and mental degeneration. Their use of hieroglyphics in writing and their fondness for tattooing show atavistic qualities. Their cranial capacity is much below the average, and the great majority of them³ show signs of physical degeneration, in asymmetry of face, anomalies of teeth or ears, or in the enormous lower jaws found in three times as large a proportion of them as of normal women. They have also longer hands and arms, and often a prehensile foot.⁴

III.

TREE-WORSHIP.

Passing from the present evidences, in man's body and in his soul, of earlier conditions of existence which have profoundly modified these, let us look at the testimony of the beliefs and customs of mankind. We now pass, then, from individual to social psychology. And first to gain an idea of the widespread belief in tree-spirits, as extended perhaps in space and time as the human race itself. The mythology of the ancients and the folk-lore of the moderns abound in evidence. "Of all primitive customs and beliefs there is none which has a greater claim upon our interest than the worship of the tree, for there is none which has a wider distribution throughout the world, or has left a deeper impress on the traditions and observances of mankind."⁵ The earliest nations of history, the Chaldaeans, Persians, Egyptians, Chinese, worshipped trees. The semi-civilized peoples of to-day offer sacrifices and gifts to the tree-spirits. Among the Dyaks of Borneo certain trees must not

¹ Hartman: *Anthropoid Apes*, p. 202.

² Ellis: *The Criminal*. New York, 1890. p. 208.

³ 81% according to Madame Tarnowskaia.

⁴ See Lombroso and Ferrero: *The Female Offender*. New York, 1895.

⁵ Mrs. J. H. Philpot: *The Sacred Tree*. London, 1897. p. 4.

be cut down, or their spirits would avenge themselves on the natives. The Talein of Burmah offer prayers to the inhabiting spirit before felling the tree. The Siamese offer cakes and rice to the takhien-tree when they want to use it for boat-building, and believe that the nymph passes as guardian-spirit into the boat built of the wood. The Ojibwas hear the trees utter their complaint when needlessly cut down. Greek and Roman mythology abounds in dryads whose lives are so connected with that of the tree that they are hurt when it is wounded and die when it falls. The May-day festivals of modern Europe are relics of religious rites originating in tree-worship. The World-tree in Norse legend and in Hindoo mythology, the sacred tree of Buddha, the Paradise trees of the Hebrews, the Persians, the Arabians, the trees from which the human race was born, and into which it passes, all attest the influence which this form of the life of nature has had upon the life of man.

It will be necessary to give in somewhat more detail some of the beliefs and customs regarding tree-gods and tree-demons. The primitive mind is unable to make abstractions to any great extent, or to think of ideal invisible things. Hence, in the earliest conceptions, trees were spirits, and the form of the spirit was that of the tree alone. This is a state of animism and not polytheism. Later when there comes a clearer distinction between spirit and matter, the tree is only the habitation of a spirit which has a more or less human shape, and the symbolic representation of such spirits employs a dress of leaves or flowers or a branch carried in the hand.

The Wanika in Eastern Africa think that every tree, especially the cocoanut, has a spirit, and because it gives life and nourishment, its destruction would be matricide.¹ The Siamese Buddhist monks think that to break a branch of a tree is like breaking a person's arm, and cutting down a tree is dispossessing a soul. In some parts of Austria peasants will not allow even the bark of a tree to be cut, and in felling a tree they always beg its pardon. Some Asiatic peoples offer gifts to a tree before felling it, to appease the spirit, who might otherwise avenge himself for being thus left without a dwelling. In Sumatra, as soon as a tree is felled, a sprout is planted on the stump as a new home for the spirit, and coins are placed on it as a compensation for the disturbance.² The wails of the trees when cut down have been heard even in England not many years back. The sacred grove of Samoa, in which no tree was allowed to be cut, is mentioned by many travellers, and the story is told by the natives of some un-

¹ Fraser: *Golden Bough*. London, 1894. Vol. I, p. 59.

² *Op. cit.*, p. 63.

believing strangers who attempted it, but soon fell ill and died, after seeing blood flow from the wounded tree. That trees were believed to be not simply the dwelling places of spirits but their bodies, is further shown by such accounts as Ovid's of the "sap gushing crimson-red from the wounded bark" of an ancient oak.¹ In Livonia is a sacred grove in which if any one fells a tree it is believed he will die within a year. The life of the Greek dryads depended upon the life of the tree which they inhabited, though they had the power of leaving their abode and wandering at will as beautiful maidens. Similar to this is the legend of Alexander and the flower maidens. In a certain wood enormous flowers grew out of the ground, from each of which leaped forth a beautiful maiden whose singing rivalled the birds and brought forgetfulness of all sorrow. But when the flowers faded in the autumn the life of happiness which Alexander and his Knights had lived in companionship with these creatures of loveliness came to a sorrowful ending.²

The Satyrs of the Greeks and the fauns of the Romans were deities of vegetation to whom offerings of fruit and grain were made, to gain their good-will and thereby abundant harvest. In Saxony elder branches may not be cut until permission has been asked of the hylde-moer (elder-mother) who dwells therein, the formula repeated three times on bended knee, being "Lady Elder, give me some of thy wood; then will I give thee also some of mine when it grows in the forest."³ Fairies, elves, and pixies are usually of kindly character, but must not be lightly offended. They are still believed in by many of the peasantry of even Germany and England. The oak is their favorite resort, but in Scandinavia the black dwarfs hold their revels under the elder tree.⁴ A species of Teutonic wood-sprite called the *schrat* were objects of special worship in the earlier centuries of the present era, and had trees and temples dedicated to them, though they were usually wild and shaggy in appearance and elfish in character.⁵

Though there are many wood-spirits of evil or questionable character, yet considering the sacredness of trees in general and the forest-worship of many peoples, the beneficent and god-like character of tree-spirits is far more predominant than the satanic. Evil spirits, however, as well as good, still inhabit the

¹ See Mannhardt: *Baumkultus*. Berlin, 1875. pp. 34, *et seq.*

² Mannhardt: *Antike Wald-und Feldkulte*. Berlin, 1877. pp. 1-2.

³ Folkard: *Plant Lore, Legends and Lyrics*. 2nd ed., London, 1892, pp. 80-81.

⁴ Folkard: *loc. cit.*, p. 67.

⁵ Grimm: *Teutonic Mythology*. tr. by Stallybrass. London, 1882-1888. p. 481.

forests of Europe. The Lyeshy of the Russian peasants somewhat resembles the mediaeval pictures of the devil, with horns, hoofs, claws and shaggy hair. The similarity extends to the character also, for the Lyeshy constantly causes travellers to lose their way, by altering landmarks or assuming the likeness of some tree which has formerly been used as a guide. Sometimes the spirit takes the form of a traveller and engages the passer in conversation so absorbing that he forgets his course and soon finds himself in a swamp or ravine, the loud laugh of the demon telling him that he has been duped.¹ The success of the sportsman depends on the good-will of the Lyeshy, so to please this spirit a piece of bread, or a pancake sprinkled with salt, is laid on the stump of a tree as an offering. The hunters of some districts present him with the first animal bagged, leaving it in an oak forest. The Perm peasants offer up prayers to him once a year, presenting him with tobacco, of which he is fond. If any one falls ill after returning from the forest his friends say, "He has crossed the Lyeshy's path." A cure is effected by carrying bread and salt to the forest, and uttering a prayer over the offering.

These evil spirits quarrel among themselves, using huge trees and massive rocks as weapons. Hurricanes are really their combats, and the creaking of branches their voices. The echoes of the wood are their calls to allure unwary travellers to dangerous ground.²

The iron-wood tree of Tahiti is regarded as the embodiment of an evil spirit, perhaps because it has furnished material for all the weapons of warfare in the past history of the people. Connected with the origin of this tree in the island there are legends of a powerful but malignant spirit.³ The Pàdams of Assam think that when a child is lost it has been stolen by the tree-spirits, and as a retaliation they cut down trees until they find it. The spirits, fearing that they may be left without a tree in which to live, give up the child, and it is supposed to be found in the fork of a tree.⁴ In Hadramant it is dangerous to touch the sensitive mimosa, lest the spirit of the plant avenge the injury.⁵ When Omayya and Abi 'Amir, who lived a generation before Mohammed, set fire to a tangled thicket with the purpose of bringing it under cultivation the jinni of the place, in the shape of white serpents, flew off with cries of woe, but

¹ Ralston: *Songs of the Russian People*. London, 1872, 2nd ed., pp. 157-8.

² Ralston: *op. cit.*, pp. 153 *et seq.*

³ See Gill: *Myths and Songs from the South Pacific*, pp. 82-5.

⁴ Fraser: *Golden Bough*, quoting Dalton's *Ethnology of Bengal*.

⁵ Robertson Smith: *Religion of the Semites*. New York, 1889. p. 125.

soon avenged themselves by the death of the intruders.¹ The moss-woman of Central Germany, "loosely clad from neck to foot in a mantle of moss from the maple's root," is another of the unfriendly spirits that are a terror to the peasants, though they may sometimes help industriously in the harvest field.² A Bengal folk-tale tells of a banyan tree haunted by ghosts who wrung the necks of all who were rash enough to approach during the night.³ The Burman hunter deposits some rice and ties together a few leaves whenever he comes across a tree of imposing appearance, lest there should be a Nat or wood-spirit dwelling there.⁴ Among the Bongos of Africa malignant spirits are believed to inhabit gloomy forests, and all old people, especially women, are suspected of having relations with these and of consulting them when they wish to injure their neighbors. With the Niam-Niams, also, the forest is a shelter for evil spirits who are constantly conspiring against man. The rustling of the leaves is the mysterious conversation of these ghostly inhabitants.⁵

The sacred groves of the middle ages and the holy trees which are still worshipped are direct survivals of the tree-spirits of earlier times. It is literally true that "the groves were God's first temples." "Temple means also *wood*. What we figure to ourselves as a built and walled house, resolves itself, the farther back we go, into a holy place, untouched by human hand, embowered and shut in by self-grown trees. There dwells the deity, veiling his form in rustling foliage of the boughs. . . . Here and there a god may haunt a mountain-top, a cave of the rock, a river; but the grand general worship of the people has its seat in the grove."⁶ After the introduction of Christianity among Germanic tribes, as a compromise to heathen customs the places of worship were still in the groves, and only very gradually did the worship of trees give place to a less materialistic form. For some time after conversion the people continued to light candles and offer sacrifices under particular trees. Down to the present, wreaths are hung upon them, and religious dances held under them.⁷ In the principality of Minden on Easter Sunday the young people used to dance around an old oak with loud shouts of joy, and near Wormelu still stands a holy oak which the inhab-

¹ Robertson Smith: *loc. cit.*, p. 125.

² Philpot: *loc. cit.*, p. 67. Mannhardt: *Baumkultus*, pp. 74-86.

³ Folkard: *loc. cit.*, p. 79.

⁴ *Ibid.*

⁵ *Ibid.*, p. 80.

⁶ Grimm: *op. cit.*, p. 69.

⁷ Grimm: *op. cit.*, p. 649.

itants of the village visit in solemn procession every year.¹ To the ancient Prussians, Romove with its holy oak, hung with cloths and images, was the most sacred spot in the land. No unhallowed foot could be set in the forest, no tree felled, not a bough injured, nor a beast slain.² In some of the sacred groves, far as the shade extends not a strawberry is picked.³ At Upsala, the old religious capital of Sweden, there was a sacred grove in which every tree was regarded as divine. The common people believe that breaking a bough from an ash is very dangerous,⁴ the ash being, next to the oak, the most sacred of all trees among Teutonic nations. The oak was sacred to the Druid god Buanawr. The mistletoe, "the tree of pure gold," as it was called,⁵ growing on the oak, was gathered with great pomp and solemnity. After due preparation the tree was hailed as the universal healer, and beneath it were brought two white bulls whose horns had never been bound; a priest in a white robe cut the mistletoe with a golden sickle, the falling branches being caught in a white cloth. Everywhere among the Semites, too, the tree was adored as divine,⁶ and one of their modern representatives, the Arab, believes certain trees to be sacred, and accordingly honors them with sacrifices and decorations. They are called *manāhil*, places where angels or jinni descend with dancing and song. From these trees not a bough must ever be plucked.⁷ In earlier times the sacred date-palm was worshipped at an annual feast, and hung with fine clothes and women's ornaments. To the sacred acacia the people of Mecca resorted, decorating it with weapons, garments, ostrich eggs and other gifts. By the Phœnicians plants were esteemed as gods, and honored with libations and sacrifices.⁸ Among the Canaanites every altar had its sacred tree, and in the early Hebrew worship the *asherā*, a planted tree, was a symbol of deity. Even in later times, when the planting of the *asherā* beside the altar was forbidden,⁹ as being associated with heathen customs, the sanctuary was beautified by "the glory of Lebanon" and other evergreens.¹⁰ The cedar has always been regarded by the Jews as sacred, and even to-day the Greeks and Armenians go up to

¹ *Ibid.*, pp. 73-4.

² Grimm: *loc. cit.*, p. 77.

³ *Ibid.*, p. 648. Foot-note.

⁴ *Ibid.*, p. 651.

⁵ Davies: *Mythology of the British Druids*, 1809, p. 280.

⁶ See Sayce: *Religion of the Ancient Babylonians*.

⁷ Robertson Smith: p. 169.

⁸ Robertson Smith: *op. cit.*, p. 169.

⁹ Deut. 16:21.

¹⁰ Isa. 60:13. See also Jer. 3:13. Other tree personifications are found in Judg. 9:8-15; II Kin. 14:9, etc.

the cedars of Lebanon and celebrate mass beneath them, at the feast of the Transfiguration.¹ In the Roman church the number of trees and plants dedicated to the Virgin Mary, the Saviour, and the saints, is too large a list to be enumerated, while at each festival the church is adorned with particular branches and flowers whose symbolism is supposed to be especially appropriate—as the edelweiss, the emblem of immortality, for Ascension Day; the trefoil for Trinity Sunday. The holly or “holy tree” as a Christmas decoration is wide-spread.

Tree-worship is deeply rooted in Malay cosmogony, and on giant trees, or such as have become twined together, a shrine of some kind is always to be found, with offerings to the spirit.² Guatama Buddha is represented as having been a tree-spirit forty-three times in his previous incarnations, and it was under the peepul or bo-tree that he achieved perfect knowledge. It thereby became specially sacred, and its leaves, or its successors’, are still gathered and treasured by pilgrims. “The history of the transference of a branch of the bo-tree from Buddhgayâ to Anurâdhapura is as authentic and as important as any event recorded in the Ceylonese annals. Sent by Asoka (250 B. C.), it was received with the utmost reverence by Devanampiyatissa, and planted in a most conspicuous spot in the center of his capital. There it has been reverenced as the chief and most important ‘numen’ of Ceylon for more than 2,000 years; and it, or its lineal descendant, sprung at least from the old root, is there worshipped at this hour. The city is in ruins; its great dagobas have fallen to decay; its monasteries have disappeared, but the great bo-tree still flourishes according to the legend ‘evergreen, never growing or decreasing, but living on forever for the delight and worship of mankind.’ Annually thousands repair to the sacred precincts within which it stands, to do it honor, and to offer up those prayers for health and prosperity, which they believe are more likely to be answered if uttered in its presence. There is probably no older idol in the world, certainly none more venerated.”³

The sacred tree of Kum-Bum is not permitted to be touched. The bark and leaves are said to contain letters of the Thibetan alphabet.⁴ The Bygas of Central India carefully preserve certain trees and present them offerings of food, clothes or flowers. They will often turn aside before some tree, and

¹ Folkard: *op. cit.*, p. 23.

² Ratzel: *History of Mankind*. Tr. by Butler, London, 1896, Vol. I, p. 471.

³ Fergusson: *Tree and Serpent Worship*, 2nd ed., 1873, p. 59.

⁴ Nature, March 5, 1896, p. 412.

bowing reverently implore the protection of the spirit, and offer up, if nothing else is at hand, a torn fragment of the already scanty garment.¹ The Zend-Avesta ordained that the trees which the god Ormuzd had given should be prayed to, as pure and holy; and when Zoroaster died his soul was translated into a lofty tree on a high mountain.² All the un-educated classes in Japan believe trees to be the dwellings of spirits, and graves always have evergreens planted near by, perhaps as an abode for the departed soul. Old trees are especially sacred, and the reverence for Shinto temples is increased by the overshadowing trees. One of the most popular dramas of Japan is a play in which a female tree-spirit, in the form of a beautiful woman, marries a human, and for many years keeps secret the dependence of her life upon that of the tree.³ Japanese mythology speaks of holy Sakaki trees growing on the mountains of heaven, and of an herb of immortality on the Island of Eternal Youth.⁴ The Siamese have such dread of destroying trees that all tree-felling is relegated to the lowest criminals. Maspero says that Mussulman and Christian fellahin alike worship at the present day the sacred sycamores that grow on the sands of Egypt, and beside them jugs of water are constantly replenished for travellers, who requite the benefit with a prayer.⁵ The enormous Baobab is worshipped by the negroes of Senegambia. The Susa palm is sacred in Borneo, the Dragon tree in the Canary Isles. The Lotus of the East is found in Northern Africa, India, China, Japan, Persia and Asiatic Russia, and in all these countries is held sacred.⁶

The prevalence of tree-worship in Ancient Greece and Italy is seen by the number of trees dedicated to deities—as the oak to Zeus, the laurel to Apollo, the olive to Athena, the myrtle to Aphrodite. The adventures of Hercules in the garden of the Hesperides resemble the account of the forbidden fruit of Eden. The Argonautic Expedition was undertaken to recover a golden fleece that hung on a sacred tree. The oak grove at Dodona, founded by the Pelasgi, 1600 B. C., remained an oracle down to Constantine's time. The rustling of the leaves and the whirring of the sacred pigeons' wings combined

¹ *Cornhill Magazine*, Nov., 1872, pp. 598 and 601.

² Philpot: *op. cit.*, p. 13. References to tree spirits guarding the destinies of man are found in the *Tales of the Genii*, trans. from the Persian by Sir Chas. Morell, London, 1805.

³ For these facts on Japanese tree-worship I am indebted to my friend Minosuke Yamaguchi.

⁴ Philpot: *op. cit.*, p. 16.

⁵ *Dawn of Civilization*, 1894, pp. 121-2.

⁶ Folkard, p. 23.

to produce the sounds that were interpreted as oracles throughout the whole period of Greek history. Even when the sacred oaks were cut down, a piece of the wood in the boat's prow or keel was able to communicate to the sailors the will of Zeus.¹ As an oracle the Delphian laurel was no less famed than Dodona's oak. The sacred fig tree of Romulus was worshipped for centuries.

Certain trees in England are known as "gospel trees," because it was customary, in marking the limits of the parishes, to stop at remarkable trees, and recite passages from the gospels.² One of the best known examples of tree veneration among the Germans is the "Stock am Eisen," still standing in the center of Vienna. Into this tree every apprentice, until very recent times, before setting out on his *Wanderjahre* drove a nail for luck.³

Among North American Indian tribes the Omahas have two sacred trees, the ash and the cedar—the ash connected with beneficent natural powers and the cedar with destructive agencies. The Athapascans hold sacred the same two trees, because they were the first to be discovered by the gods. In the Osage traditions, cedar symbolizes the tree of life.⁴ Among the Dakotas the tree which is to serve as the sacred sun-pole is cut down and taken to camp with great ceremony, no one touching it on the way or going in advance of it.⁵ Darwin mentions a tree to which homage has been paid by offerings of cigars, bread and meat; and Tylor speaks of a cypress in Mexico, many centuries old, decorated with locks of hair, teetli, bits of colored cloth and ribbon. The Calchaquis of Brazil decorated sacred trees with feathers.⁶

A glance at harvest festivals, May-day celebrations and Christmas customs, shows them to be relics of tree-worship and survivals of the belief in the power of spirits to grant abundant vegetation in fruit and grain.

In earlier times the human representative of vegetation was sacrificed that the divine spirit in him might be passed on to his successor, and thus preserved without the loss of any vigor.⁷ In winter vegetation is interpreted as being enfeebled, and must be slain and resurrected in fresher form. The death of the representative of the tree-spirit was thus for the purpose

¹ Fergusson: *loc. cit.*, p. 17.

² *Flower Lore*, p. 28. "Dearest, bury me under that holy oak or gospel-tree."—Herrick.

³ Fergusson: *op. cit.*, p. 22.

⁴ *Eleventh An. Rep.*, Bur. Ethnol., Washington, p. 391.

⁵ *Ibid.*, pp. 453-7.

⁶ Dyer: *Folk-Lore of Plants*. New York, 1889. p. 37.

⁷ Fraser, Vol. I, p. 240.

of quickening vegetation. In later times and among more civilized peoples, the representative of the spirit of fruitfulness is slain only symbolically, the custom surviving but losing its solemn character. Still later it becomes only a pastime, all knowledge of its significance being lost. The May-day customs of England are a survival of the festival of *Floralia*, introduced by the Romans. The significance of the custom is clearly seen in the variation of it by which the May-day procession left at each house a small tree or branch, thus bestowing prosperity and fruitfulness for the year.

The decay of meaning from the ceremonies can be traced in the different methods of representing the spirit—first, by a tree alone, then by a tree and living person, later when the savage nature of the rite has died out, by a tree and puppet, and lastly by a person only whose representative character is shown by the dress of leaves, the crown of flowers, or the name Queen of the May.

The autumn festivals are similarly a thanksgiving to the god of agriculture for abundant fruitage, and an invocation of future favor. The Jewish feasts¹ and Christian "harvest-homes" embody the same conception with the grosser elements omitted. The Greek feasts of *Thargelia* and *Pyanepsia* were later imitated in France and parts of Germany, by bringing home from the harvest-field on the last load of grain a branch adorned with flowers, ribbons and fruit. In all these customs the tree-spirit is conceived as the spirit of vegetation in general.

The Christmas tree is partly a survival and partly a revival of such customs. In the Christmas festivals of the Harz the maidens dance and sing around a fir tree which has been decorated with eggs, flowers, and other ornaments. Santa Claus, or Nick, is the demon treed in the branches and made to bestow gifts.² In Germany trees are married by being tied together with straw ropes on Christmas eve to ensure their yielding well. There is a similar custom in India. The belief in the fertilizing power of the tree-spirit is seen in the marriage rites of different peoples. In modern Greece the priest is provided with chaplets of lilies and ears of corn, which he places on the heads of bride and bridegroom as emblems of purity and abundance.³ The myrtle, an emblem of purity and fertility, is still used in Germany for the bridal wreath, and in one part of the country the bride wears a garter of flax as an invocation to the spirit of

¹ Lev. 23:39, 40; Ex. 23:16.

² Conway: *Mystic Trees and Flowers*. Fraser's Magazine, 1870, Nov. and Dec.

³ Hilderic Friend: *Flowers and Flower-Lore*. London, 1884. p. 133.

fecundity. The custom in Brittany of giving a branch of laurel to a bride, and in Russia of placing a pine bough in her home, has the same underlying idea.¹ Even the orange blossoms of the present day, in England, France, and America, were first worn by Saracen brides as a symbol of fertility.²

The divining rod, still used in England and in this country for the detection of water-veins, is a survival of the sacred tree, with its magic powers. Rhabdomancy was in earlier times extensively employed in the discovery of minerals or of lost objects, and in bringing criminals to justice. The hazel is the favorite wood, though fruit trees have been largely used. The directions for cutting the bough are often elaborate, reminding one of other ceremonies connected with tree-worship: it must be that year's shoot, with a fork standing so that the sun from east to west shines through; it can be cut only between three and four in full moon Sunday morning. He that gathers it must walk in silence, with his face to the east, bowing three times and saying: "God bless thee, noble spray and summer's bough."³ This form of divination was practiced, though forbidden,⁴ among the ancient Israelites, and is mentioned in close connection with the worship of trees.⁵

Planting or dedicating trees to the memory of heroes or great events is the most modern form of tree worship. The "Charter Oak" in Connecticut, the "Liberty Elm" of Boston Common, the Ash trees of Mt. Vernon, the Penn tree in Philadelphia, are instances in our own country of making trees the "monuments of history and character."

This, given in the briefest and most unsatisfactory form, is the evidence. The question to be considered is: How came man to have such thoughts and feelings toward the trees? Spencer answers, "Plant-worship, like the worship of idols and animals, is an aberrant species of ancestor-worship—a species somewhat more disguised externally, but having the same internal nature;" and Grant Allen supposes trees to have become objects of worship by their association with the graves of the reverenced ancestors. But surely trees were believed to be sentient beings, and regarded as possessing a power which could be used to the disadvantage of man, long before ancestor-worship could have been possible or immortality conceived, because long before man had drawn any clear distinction between material and spiritual. Spencer himself, and Darwin as well, would give the germs of religious feeling to the higher

¹ Mannhardt: *Baumkultus*, pp. 222 and 46.

² Friend: *op. cit.*, p. 112.

³ Grimm: *loc. cit.*, p. 975.

⁴ Hosea 4:12.

⁵ Hosea 4:13.

animals. But it would hardly be claimed that animals can retain for very long any thought of dead comrades, their imagination of objects not present to the senses being very limited. Nor have we any reason to suppose that their waking intelligence is greatly influenced by their dreams. In fact they are far from being capable of making any such abstraction as spirit apart from body.

To make ancestor-worship the origin of religion seems to be the exact opposite of the process which mental evolution has followed. Man did not begin with the distinct notion of himself as a being separate from all else in the universe, and later proceed to endow the objects surrounding him with his own mental characteristics. Rather, all nature was to him one, other animals and objects possessing the same mental qualities and powers as himself. Only much later did he begin to differentiate himself, and the real question is not, Why should primitive man have believed trees to be spirits? but, Why should he not? and How came it about later that he did not? And the real answer seems to be that man, through his developing self-consciousness, has got out of his primitive mental relation to the universe, has evolved an egoism which thinks the object of its own self-contemplation to be the only thing worthy of consideration and deprives all things else of the powers and qualities which are called "high," that is, of everything except materiality.

Primitive man, before he began to philosophize, or to analyze himself, was a part of nature, not knowing nor feeling himself a separate and higher thing than the rest of nature about him. He was a part or an element of the great unity; other things around him were similar to himself—able to think and feel. Why should he not ascribe life and spirit to such objects as trees which grew as he did; which possessed the power of motion within limited spaces; which uttered sounds no more unintelligible perhaps than the language of foreign tribes; which expressed by movements such emotions as anger or joy, that he himself showed by similar gestures? Why should not the strength of an oak inspire him with the thought that it was a powerful spirit? The distinction between body and spirit even in himself was vague at first; and is so still in the lowest races. Only to a very limited extent is abstract thought possible. The attributes of spirituality, as distinguished from those of materiality, are not well defined in the savage mind. Their gods, for example, are mortal, like men. This lack of mental ability in discrimination was conducive to the massing of all objects of nature under general characteristics, such as the man felt and knew in himself. It would be very improbable that he should be able to mark himself off clearly as a

different sort of being from others in nature with which he lived in such close contact. Only when he began to conquer nature and turn it to his account, and the philosopher awoke in him, did he begin to perceive himself superior to his environment. Only when he began to reason about his own soul, and lose his close relation to external nature, did he begin to question the possession of souls by the objects about him. Only when he turned his gaze within, and lost his former perspective, did he begin to imagine that *he* was the universe. The reversion from this perverted view is only taking place in the second half of the nineteenth century. The poets have never quite lost sight of the thought that man is only an essential part of the great unity of nature, and to them the trees, the flowers, and the streams, have ever been living things, of thought and feeling, desire and will. Children, too, representing the childhood of the race, have always believed trees to be alive and sentient, as a later section shows. Not only children, but even men of primitive stamp, show their atavistic belief in the intelligence and morality of inanimate things by kicking in anger an object that has injured them.

The general appreciation of nature, however, has grown up only within the memory of those living, and the philosophic thought of unity in the world is a modern concept. Along with this has come an appreciation of the myths of primitive peoples and a sympathetic understanding of their value in disclosing the mental life of the races from which these legends have descended.

This conception reverses the method of viewing the question of the origin of tree-worship, and of religion in general. Instead of the theory of the origin of worship which begins from the human side and makes the worship of other objects of nature merely secondary and accessory, through association, the present supposition would substitute a broader basis in the whole of nature, and carry the origin of the religious feeling far back to the pre-primitive period when man, just merging into humanity, did not consciously differentiate himself from all nature. The great gulf between man and lower nature, as he chooses to call it, has been fixed by man himself only in the later stages of his intellectual development.¹

The pedagogic import of this is evident. Children are already and naturally in sympathetic *rapport* with nature. Our training of them must contain enough *letting alone* to allow this attitude toward nature to continue. This reverence for nature, and feeling of *at-home-ness* with her, is one aspect of the child-like

¹ These pages were written before I had seen Dr. Tylor's chapters on Animism. I am glad to find that part way we travel the same road.

spirit which surely need never be outgrown. Scientific dissection and classification of objects is as artificial and unsuited to child-mind as similar abstraction and generalization would be to the lowest savage.

From tree spirits to tree worship is an easy transition. When trees are regarded as powerful spirits, able to do good or evil, the primitive intellect is not slow to recognize the necessity of appeasing the wrath, and the advantage of gaining the favor, of such beings. Prayers and offerings are a natural consequence, and dendrolatry arises out of animism. No doubt in an age when the struggle for existence was fiercer and had fewer of the humanizing characteristics of civilized times, the gods, too, like men, were regarded as chiefly malignant, and this thought still survives in the variety of evil spirits, as elves, witches, dwarfs, lyeshy. But the good offices of trees, in furnishing shelter, protection, and food, were also recognized, and tree-spirits came to be regarded as predominantly beneficent. The sacred trees still worshipped in the times when subjective and objective are more clearly differentiated, are direct survivals of this mode of thought; and the divining rod unquestionably gets its magic powers from its being the branch of a sacred tree. Trees planted in honor of some hero or dedicated to the memory of a national event, become objects of reverence by association. They are the representatives of the spirits held sacred.

It may be that trees do not stand on an equality with other objects of nature, with regard to animistic beliefs. The voices of the leaves, and the movement of the branches, of course give trees a greater likeness to men than noiseless and immovable objects possess. But in addition to this it is possible, in accordance with the preceding sections, that trees may hold a specific relation to man, that no other natural objects have. Man's arboreal life may have evolved certain intellectual and emotional characteristics, suggestions of which we still find in primitives and children. It may be, for instance, that the feeling of safety from enemies, afforded by the trees, developed an instinctive attitude toward these protecting objects, which survived far beyond the time of arboreal life, forming a basis in the evolving consciousness, of a special regard for trees, and a feeling that they were more powerful and more friendly than other spirits. Suggestions of this are seen in the great predominance of good tree-spirits over evil, and the universal worship of trees among primitive peoples, and in the unaccountable fondness of children for trees.

IV.

THE LIFE-TREE.

Out of these relations between the tree and human life there comes another. We have only to carry the notion of tree-spirits a little farther to get a race of men born from the trees. In the earliest stages of primitive life the tree itself is believed to be a spirit. This, when the distinction between body and soul begins to be made, grows into the conception of a spirit inhabiting the tree. Later this spirit, as in the case of the Greek dryads, is able to leave its dwelling for a time, but cannot maintain its life quite apart from this habitation. This connection between life and tree, which has thus been growing less intimate and necessary, is at last entirely broken by a continuation of the same process; but a tradition of the earlier relations remains, and we have the myth of a human race descended from trees. Of the almost universal existence of such a myth there is ample evidence.¹

In Norse legend the first human pair, Askr and Embla, were born of two trees, an ash and an elm, found on the sea-strand by Odin and his brothers. From these all mankind are descended.² Similar to this in Greek mythology is the formation of the brazen race by Zeus out of ash trees.³ Both Greeks and Romans had a belief of origin from the oak. Virgil writes:

"These woods were first the seat of sylvan powers,
Of nymphs, and fauns, and savage man, who took
Their birth from trunks of trees and stubborn oak."⁴

In Persian legend Ormuzd gave souls to a plant which had first grown up as single, and afterward divided into two. These became Maschia and Maschiâna, the parents of the human race.⁵ The Mayas say they are "the sons of the trees," and an American Indian myth makes man spring from the trees. The Aztecs revered the tree-form, calling it the "tree of our life." The Mexicans believed the human race to have arisen from the seeds of their sacred moriche palm. In many parts of Germany a hollow tree is believed to be the abode of unborn infants. In a Finnish fairy-tale a foundling is called *punhaara*, tree-branch.⁶ The poet's unity with nature suggests to him the same mystic relation.

¹ Dr. Hall suggests to me that the myth of creation from trees might have arisen from the fact of earliest human life having been supported by the fruit of trees.

² *The Younger Edda*, tr. by Anderson, 1880, p. 64.

³ Hesiod: *Works and Days*.

⁴ *Aeneid*, VIII, 314-5.

⁵ Mannhardt: *Baumkultus*, p. 7.

⁶ Grimm: *op. cit.*, p. 1451.

" I care not how men trace their ancestry,
 To ape or Adam ; let them please their whim ;
 But I, in June, am midway to believe
 A tree among my far progenitors—
 Such sympathy is mine with all the race."¹

The same subtle sympathy was felt by Hawthorne toward the ash trees shading the manse at Concord.

The opposite process, of the transformation of mortals into trees, finds equally numerous illustrations. The sisters of Phaëton, changed into poplars, bewailing the death of their brother, on the banks of the river into which he had been hurled ;² Daphne, transformed into a laurel, to escape the attentions of Apollo ; Cybele, in anger changing her lover Attis into a pine, whose perpetual verdure was bestowed by Zeus in compassion for the remorse of the goddess ; Philemon and Bau-cis, whose spirits were transferred into trees, so that neither might witness the death of the other ;³ the beautiful Thracian queen Phyllis, expiring of grief for the unfaithfulness of her husband, and transformed into an almond tree on the shore where she awaited his coming,—these and many others are classic examples. Buddha's many incarnations in trees have already been mentioned. Japan has a story of a faithful pair, who after enjoying many years of happiness, died at the same moment, their spirits passing into a tall pine, which a god had once planted in passing that way. On moonlight nights they may still be seen gathering the pine needles under the tree which is called the "Pine of the Lovers."⁴ The Chinese have a legend telling how a husband and wife were transformed into cedars in order to perpetuate their love. A secretary of the king had a young and beautiful wife whom the king coveted, and to gain possession of her the secretary was thrown into prison, where he died of grief. To escape the king's attentions the wife threw herself from a high terrace, having left a request that she should be buried beside her husband. This the king in anger refused to grant, but from the two graves, though widely separated, there sprang two cedars which in ten days grew so tall and vigorous that their roots and branches interlaced, and the cedars were henceforth called "the trees of faithful love."⁵ Among some South Sea Islanders the cocoa-nut tree is believed to be a transformed god, whose eyes and mouth appear in the fruit. The white kernel is commonly called "te roro o Tuna," *the brains of Tuna.*⁶

¹ Lowell.

² Ovid : *Metamorphoses*, II, 346-366.

³ Ovid : *op. cit.*, VIII, 711 *et seq.*

⁴ Mrs. Philpot, p. 83, quoting Rinder's *Old World Japan*.

⁵ Folkard : *op. cit.*, p. 274.

⁶ Gill : *op. cit.*, pp. 77-9.

From these two conceptions—creation from trees and transformation into them—arises the more specific notion of a sympathetic connection between the life of a person and that of some particular tree. A Czech story tells how a child, born of a mortal and a tree nymph, was able to hold converse with her mother by means of a pipe made from twigs of the willow tree which her mother had inhabited. Among the Romans it was usual to plant a tree at the birth of a son, and this custom is still prevalent in America, England and France, as well as in Italy. In Switzerland an apple-tree is usually planted for a boy, and a pear-tree for a girl. The life of the child is believed to be so intimately associated with that of the tree that he will thrive or fade according as it flourishes or withers.¹ The Dyaks of Borneo plant a palm; in Bali a cocoanut tree is planted and called the child's "life-plant." Such trees are cared for with an almost superstitious devotion. Byron believed that his life and prosperity were bound up in an oak planted when he first visited Newstead, and on its fate depended his. The sycamore tree of the Cary sisters is well known.

The sympathetic relation sometimes extends to whole tribes or sects, as in the case of the patrician and plebeian myrtles before the temple of Quirinus, whose vigor depended upon the fortunes of the two political parties; or the weeping willows in sympathy with the sorrows of the Israelites.² The Italian belief that the bay-tree withered and died at the approach of a national calamity is preserved by Shakespeare.

"'T is thought the king is dead; we will not stay.
The bay-trees in our country all are withered.'"³

Every one knows the mediæval legend that the aspen, being compelled to supply the wood of the cross, has never since ceased to tremble.

The earlier connection of trees with family interests is illustrated by the prevalence of family names derived from trees, as Linde, Eichbaum, Birkmayer, in Germany, and the English Holyoake, Ash, Maple, Rowan, etc., and is emphasized by folk-tales which give rise to such stories as Julian Hawthorne's *Kildhurn's Oak*.

The curative power of trees, and the sympathetic connection existing between a tree and a child who has been passed through a cleft branch, will be mentioned later.

¹ Mannhardt: *Baumkultus*, p. 50.

² Ps. 137:2. In its name, *Salix Babylonica*, the willow preserves the memory of this incident by the waters of Babylon.

³ Richard II, Act. II, Sc. 4.

V.

THE WORLD-TREE.

The conception of a world-tree is so wide-spread that it must have arisen independently among different peoples. It arose perhaps as an explanation of how the heavens were supported and the stars kept in their places. Many children think that the sky is held up on the tree-tops.

The Scandinavian ash, Yggdrasil, is the best known of the universe-trees. "By this tree is the chief and most holy place of the gods, where they meet in council every day. It is the best and greatest of all trees; its branches spread over all the world, and reach up above heaven. Three roots sustain the tree and stand wide apart; one root is with the Asas (gods), and another with the frost-giants; the third reaches into Niflheim (nether world); under it is Hvergelmer (fountain) where Nidhug (serpent) gnaws the root from below. But under the second root, which extends to the frost-giants, is the well of Mimer, wherein knowledge and wisdom are concealed. The third root of the ash is in heaven, and beneath it is the most sacred fountain of Urd. Here the gods have their doomstead. The Asas ride hither every day over Bifrost (rainbow), which is also called Asa-bridge . . . Thor goes on foot to the doomstead and wades the rivers.

When he goes to judge
Near the Yggdrasil ash;
For the Asa-bridge
Burns all ablaze,—
The holy waters roar.

The red which you see in the rainbow is fire burning over Bifrost. The frost-giants and the mountain-giants would go up to heaven if Bifrost were passable for all who desired to go there. Many fair places there are in heaven. . . . There stands a beautiful hall near the fountain, beneath the ash. Out of it come three maids, who shape the lives of men, and we call them norns. Good norns and of good descent shape good lives, but when some men are weighed down with misfortune the evil norns are the cause of it. . . . On one of the boughs of the ash sits an eagle who knows many things. Between his eyes sits a hawk that is called Vedfolner. A squirrel, by name Rata-tosk, springs up and down the tree, and carries words of envy between the eagle and Nidhug. Four stags leap about in the branches of the ash, and bite the leaves. More serpents than tongue can tell gnaw the roots of the tree. The norns that dwell in the fountain of Urd, every day take water from the fountain, and take the clay that lies around the fountain, and sprinkle therewith the ash, in order that its branches may not

wither or decay. This water is so holy that all things that are put into the fountain become as white as the film of an egg-shell.

Thence come the dews
That fall in the dales.
Green forever it stands
Over Urd's fountain.

When Odin sits in his high seat he sees over all the world. In the southern end of the world is the palace which is the fairest of all, and brighter than the sun. It shall stand when both heaven and earth shall have passed away. In this the good and the righteous shall dwell through all ages.¹¹ In Valhal is a chest which contains the golden apples which the gods must eat to make them young again.

The inhabitants of the tree are supposed to be natural phenomena. The serpent Nidhug who gnaws the root in the lower world is volcanic force ; the stags who bite the leaves and buds are the winds ; the eagle and the hawk are the air and the ether ; the squirrel running up and down the tree is hail ; the leaves of the tree are clouds ; its fruit, the stars ; the swans swimming in the fountain typify sun and moon.

Perhaps the oldest world-tree known is that which grew at the mouth of the Euphrates, near a city which flourished three or four thousand years before the Christian Era. To plain-dwellers the tree is the loftiest and most impressive object in their experience, and it is suggestive that the origin of this world-tree is located in the garden of Eden, on the plains bordering the Persian Gulf. The fragment of a hymn reads :

"(In) Eridu a stalk grew overshadowing; in a holy place did it become green;
Its root was of white crystal, which stretched toward the deep.
(Before) Ea was its course in Eridu, teeming with fertility;
Its seat was the (central) place of the earth;
Its foliage was the couch of Zikum (the primeval) mother,
Into the heart of its holy house, which spread its shade like a forest,
hath no man entered.
(There is the home) of the mighty mother who passes across the sky.
(In) the midst of it was Tammuz.
(There is the shrine) of the two (gods)."¹²

The roots of this tree reached down to the watery deep, the dwelling place of the god of wisdom, Ea; on the branches rested Zikum, the primordial heavens, and below was the earth. The trunk of the tree was the home of Dav-kina, the great mother, and of Tammuz her son, whose temple mortals might not enter. Such a conception must have come from a tree-

¹ *The Younger Edda*: trans. by Anderson, 1879, pp. 72-76.

² A. H. Sayce: *Religion of the Ancient Babylonians*, The Hibbert Lectures, 1887, p. 238.

worshipping nation. "The mighty stem in which the great gods dwelt was but a poetical amplification of the sacred spirit-inhabited tree, and arose out of the same idealizing process as that which gave birth to the nearly-related tree of knowledge and tree of life."¹

In the Indian cosmogonies there are world-trees of many names, as emblems of immortality and of universal life—sacred trees bearing ambrosia, the food of the gods, growing beyond the mystic river whose waters give eternal youth; cloud-trees with shadows producing day and night before the creation of the sun or moon, growing in the midst of flowers and rivers, imparting all riches and knowledge, satisfying all human longings, and conferring perfect bliss; universe-trees, which become, in the Rigveda, Brahma himself, with all the other gods branches of the divine stem. Closely parallel with these is the world-tree of the Buddhists, giving wisdom, furnishing immortal food, protecting the souls of the blessed. It sparkles with precious stones, the stars, and is laden with divine flowers. Under this tree it was, that Buddha fought his battle with the tempter, on a night forever after sacred to the Buddhists, and gained the victory which gave him possession of the tree of knowledge and the freedom which comes through truth. Very similar also is the Haoma of the Zoroastrians, planted in heaven by Ormuzd, scattering its thousand seeds to all the parts of the earth;² and the sacred tree of the Assyrians, Phoenicians and Israelites, which represented the great Deity, and was worshipped as a symbol of Him.³ China and Japan have their universe-trees, the former a huge pine growing at the center of the world, the latter seven miraculous trees conferring immortality.

But ancient and oriental nations are not the only peoples among whom is found this conception of a tree overshadowing and protecting the world or yielding the fruit of wisdom and immortality. Traces of such a tree are found in Russian legend—a tree whose root is the power of God and whose top sustains the heavenly ocean of air, the earth and hell. Among the Finns the Kalevala, their national epic, tells how a mighty oak sprang from a magic acorn planted by Wainamoinen, raised itself above the storm-clouds, dimming the sunlight, hiding the moonbeams, causing the stars to die in the heaven, until the hero, alarmed at its growth, appeals to his mother, the wind-spirit, who sends forth a dwarf grown into a giant, whose

¹ Philpot: *op. cit.*, p. 112.

² Sacred Books of the East, edited by Max Müller, Vol. XXIII, *The Zend-Avesta*, Pt. II, p. 173.

³ Folkard: *op. cit.*, p 6.

might overcomes the oak. It falls and its power to bestow good is only then discovered :

"Eastward far the trunk extending,
Far to westward flew the tree-tops,
To the south the leaves were scattered,
To the north its hundred branches.
Whosoe'er a branch has taken
Has obtained eternal welfare.
Who secures himself a tree-top
He has gained the master-magic.
Who the foliage has gathered
Has delight that never ceases."¹

Even among the North American Indians there are traces of such a tradition. A tribe of New Mexico has in each of the six points of the world (the four compass points, zenith and nadir), a mountain bearing a tree—spruce, pine, aspen, cedar, and two oaks. At the foot of each tree dwells a "cloud ruler," attended by a priestess of the tribe whose duty it is to intercede with the god to send rain.² The connection here between the tree and the sky is so evident as to suggest that the primitive gods came to be believed to occupy a position *above* the earth through their having inhabited the trees. The highest objects in nature, that are not separated from the earth, are trees and mountains. But mountains were not believed to be inhabited by spirits as trees were. They do not possess the life and movement of trees, nor grow as trees do. They have no voices, and cannot show anger as trees do in a storm. In these things trees are like men, to the primitive mind, and their importance far surpasses that of inanimate objects. It seems more probable, then, that the gods have reached the sky through the trees than by the mountains or by means of any other natural objects.

VI.

THE PARADISE-TREE.

Closely connected in thought with life-trees and world-trees are the trees of Paradise. If men are born from trees, our ancestors would naturally be thought to have had their original home amongst trees. If the tree of the universe had its topmost branches in heaven, the conception of a Paradise might easily grow out of this form of tree-worship. The sorrows of human life, and its disappointments, its ceaseless toil without recompense of love or pleasure, creates in the heart a longing for some happy, far-off land where blessedness abides. What more natural than that this should be found

¹ *Kalevala*, 2nd Rune, trans. by John Martin Crawford, N. Y., 1891.

² Bureau of Ethnology, Washington, 11th An. Rep., p. 28.

with the gods, beneath the trees which dropped ambrosia, in a garden of fragrance watered by life-giving springs and rivulets. That many peoples had such a conception, as the dwelling-place of the gods, of their own first parents, or as their future abode, is unquestioned. In a tradition of the Parsis the first man and woman, who were born from a tree, were placed in Heden, where grew the Tree of Life which gave strength and immortality. The Hindoo religion has a garden of the great god Indra, containing the trees which first grew out of the troubled waters at the beginning of creation, with their life-giving fruits and beautiful flowers. The chief of these trees was the Paridjata, whose flower was fresh all the year through and gave to each person his favorite color and perfume. Besides insuring against hunger or thirst, it had uses more spiritual for it was a test and token of virtue, losing its freshness in the hands of the wicked and preserving it with the upright.¹

The Paradise of Mahomet is in the seventh heaven. In the center of it is the great tree Tooba, so large that a man could not ride around it on the fleetest horse in a hundred years. This shows its close relation to the immense universe-trees. This tree affords shade to all Paradise, and bears fruit of a size and taste unknown to mortals. The branches even bend low to bestow their delicacies at the wish of their inhabitants. From this tree the rivers of Paradise flow with milk and honey, water and wine.² The Zend-Avesta has two Haoma trees; one yellow or golden, which is earthly and the king of healing plants; the other the white Haoma or Gaokerena, which grows up in the middle of the sea, surrounded by ten thousand healing plants, by drinking the juice of which on the resurrection day men become immortal.³ It was from this celestial tree that the full perfection of the world arose. It is "the counteractor of decrepitude, the reviver of the dead, and the immortalizer of the living."⁴ The Japanese have a similar legend of an Island of Eternal Youth from which a tree rises high above the waters; endless springtime is there and the miracle of spring in other lands is caused by the whisper of the spirit of this island.⁵ In the Hebrew Paradise, the garden of Eden, stood the tree of life in the center.⁶ The significance of this tree no one really knows. According to the Rabbins it was a supernatural tree of such vastness that no man could

¹ Folkard, p. 10.

² Folkard, pp. 10-11.

³ *Zend-Avesta*, Pt. I, Vol. IV of *Sacred Books of East*, p. Lxix.

⁴ Vol. V, *Pahlavi Texts*, Pt. I.

⁵ Mrs. Philpot, quoting Rinder's *Old World Japan*.

⁶ Gen. 2:9.

travel round it in less than five hundred years. From beneath it gushed forth the waters of the earth refreshing and invigorating all nature.¹ It resembled in fact the world-trees of the previous section. Others make it emblematic of the life that Adam and Eve received from God. At any rate it resembles the Paradise-trees of other nations in yielding a fruit which would confer everlasting life, for after the transgression of eating the forbidden fruit of the tree of knowledge of Good and Evil, and thereby making themselves unworthy of a continued existence in a garden of delight and near the presence of the Lord, the first parents were driven from Eden lest they should put forth their hands "and take also of the Tree of Life and eat and live forever."² The Christian sacred scriptures use the Tree of Life with the same signification: "to him that overcometh will I give to eat of the Tree of Life which is in the midst of the Paradise of God"³—a direct reference to the loss of the privileges of Eden through disobedience and the regaining of the lost heritage through faithfulness. The conception has a further point of parallel with the sacred trees of other nations in the healing properties of its leaves, mentioned by Ezekiel several centuries before Christ, and later in the apocalypse.⁴

Growing by the Tree of Life in the garden was the forbidden tree of knowledge of Good and Evil,—"good for food and . . . pleasant to the eyes, and a tree to be desired to make one wise,"⁵—the identity of which has given rise to so much speculation. The prevailing tradition makes it an apple tree, though the Bible offers no support to this.

A Jewish legend tells how Adam at the age of 900 overtaxed his strength in uprooting a large bush, and feeling that death was threatening him, sent his son Seth to the angel guarding the way to the Tree of Life, to ask for some of its fruit to renew his strength. Seth was given three seeds and charged to place them in Adam's mouth when he was buried. These grew up as an olive, a cedar and a cypress, but their existence was not known until the time of Moses who was ordered to cut them down. Moses, and afterwards David, performed many miracles of healing with these rods. They later grew into one tree and furnished the wood for the cross of Christ. This legend preserves the fundamental idea of the eternal-life-giving power of the Tree of Paradise. An interpretation, ingenious if fanciful, of the first chapter of Genesis makes the tree of life the human body,

¹ Folkard, p. 13.

² Gen. 3:22.

³ Rev. 2:7.

⁴ Ezek. 47:12; Rev. 22:2.

⁵ Gen. 3:6.

and the flaming sword which turned every way to guard it the blood. A similar explanation, quoted in Warren's *Paradise Found*, makes the brain the tree of life, and the blood the water of life. An idea related to this, and carried out in detail, is found in one of the sacred books of the East. A forest has seven large trees of seven fruits, seven guests, seven forms of concentration and of initiation. The probable interpretation is that the forest represents life, with the trees as the five senses, the understanding, and the will,—called trees because producers of the fruits, namely pleasures and pains, derived through them. The guests are the powers of each sense personified, the forms of concentration are the exclusion from the self of the functions of the senses, and the initiations are the entrance into the higher life by repudiating as not one's own the actions of these senses. When this forest disappears, that is, when the senses have become absorbed into the self, another tree springs up, which is intelligence and whose fruit is emancipation and shade tranquillity.¹ This again expresses the fundamental idea of the paradise tree, namely everlasting life, but in this case according to the Hindu conception of it as Nirvana.

In all these growths of religious thought concerning immortality and happiness the central idea is the tree, and the attainment of the life of unending felicity is by partaking of the fruit of this tree. Placing beside this the primitive notion that heaven was not far away, and that its occupations were similar to those of earth, we have the necessary material from which to draw the conclusion, actually arrived at by many peoples, that heaven could be reached by climbing a tree if one could only be found tall enough. The Accadians pictured the sky as the counterpart of their own Babylonian plains; the sun was a ploughman yoking his oxen to his glittering plough, and the planets were sheep.² The Bedouins of Arabia believe that the jinni, who live near the lowest heaven, can hear the conversation of angels.³ The Mbocobis of Paraguay believe departed souls to go to heaven by the tree that joins it with earth, entering by the holes through which the rain descends,⁴ and the Idaan of Borneo reach paradise by crossing a long tree.⁵ The Khasis of India have a legend which makes the stars men who have climbed to heaven by a tree.⁶ Milton's picture would allow of such an interpretation :

¹ *Bhagavadgitá, Sanatsugátiya and Anugitá*, pp. 285-6.

² Sayce: *op. cit.*, p. 48.

³ Bent: *Nineteenth Century*, Oct., 1895, p. 608, *The Land of Frankincense and Myrrh*.

⁴ Tylor: *Early History of Mankind*, 1878, p. 358.

⁵ *Ibid.*, p. 360.

⁶ Mrs. Philpot, quoting Goblet d'Alviella's *Migration of Symbols*.

"Overhead up-grew
 Insuperable height of loftiest shade,
 Cedar, and pine, and fir, and branching palm;
 Yet higher than their tops
 The verdurous wall of paradise up-sprung
 And higher than that wall a circling row
 Of goodliest trees, loaden with fairest fruit."¹

The ascent to heaven by a tree is found in myths among peoples so widely separated that an independent origin must be admitted. To those given might be added the story current among the Wyandots of a boy who climbed a tree so high that he found himself in a beautiful country, where he caught the sun unawares in a trap set for game; the other sun-catcher, among the Dog-Rib Indians, who had climbed a tree in pursuit of a squirrel until he reached heaven; the Dyak who brought rice to mankind by climbing a huge fruit-tree which was rooted in the sky, with branches hanging to earth; the Malay legend of Kasimbaha who ascended to heaven on the rattan tree to recover his wife, a celestial nymph who had deserted him; and our own nursery tale of Jack and the Beanstalk, which is a disguised representative of this group of myths.² If such myths have arisen independently among many peoples, and are not the result of some happy inspiration of a single soul, their origin must have some natural cause. This is doubtless found in the fact of universal tree-worship in the earlier stages of civilization. The tree being thus a sacred object would be closely connected in primitive thought with the idea of a divine habitation, when the gods began to be farther removed from the earth; and if the idea of such a habitation as *upward* was already in men's minds, this would suggest a further connection. May we not, however, go farther back, and say that the idea of *up-ness* itself as an attribute of heaven, and later a symbol of goodness, owes its origin to tree-worship? The idea of the gods in council, ruling the world, is a much later conception than tree-worship. When it became necessary that an assembly of gods should have a more definite location, why should not that be chosen by the primitive mind where so many of the gods already existed, namely, above the earth? This does not conflict with the notion that deities were believed to be in the sky as early as upon the earth, that the sun was worshipped in as early an age as trees. But when fetishism grew into polytheism proper some explanation must be given of how the gods of the earth, which formed the great majority, found their general dwelling-place above the earth.

¹ *Paradise Lost*, Bk. IV, 137-147.

² Tylor: *Early History*, pp. 350-6.

VII.

THE TREE IN MEDICINE.

The tree has played an important part in the cure of diseases. The most common form of treatment has been the transference of the ailment, by some magic word or symbolic act, to the tree, or rather to the tree-spirit; for here too we meet with the same underlying notion of the intelligence and personality of trees. They are believed to be subject to the same ills as those which afflict humanity; if these ills, then, can be passed over to the trees, the suffering person is relieved. The method of this transference also is a survival from the primitive beliefs regarding the way in which spirits inhabit objects, and can pass from one to another. It belongs to a later period than that in which objective and subjective were identified; a period, namely, in which the souls of men and of other objects were able to leave their usual dwelling-places, but could not exist without some habitation. As a consequence of this dependence of the spiritual on some material support, the transference of a man's disease to a tree which might happen to be distant could be effected by an object passing between the two as a medium. When possible, however, the afflicted person is brought into direct contact with the tree. All this is not merely an analogy, for when these methods were employed diseases were actually believed to be evil spirits, which were induced to leave the man when some other suitable dwelling-place was furnished them.

In England, not so long ago as a century, ash trees were split open and held by wedges while children were passed through as a cure for rupture.¹ These trees were often preserved with great care, a mysterious connection being supposed to exist between the tree and the patient.² In Austria the ceremony is more elaborate. A branch of oak is split open and the child passed through backward three times. The pieces are then tied together with the child's shirt and thrown on the fire, all being done in silence.³ In the middle ages a hole formed by the growing together of two branches was believed to be exceptionally efficacious, and such trees were visited from great distances. Near Wittstock stood a stont gnarled oak whose boughs had thus grown into each other, and all around the tree lay crutches that had been thrown away by those who no longer needed them.⁴ To crawl beneath a bramble which

¹ Gentleman's Magazine, June, 1804, and White's *Natural History of Selborne*, 1789.

² Gent. Mag., Oct., 1804.

³ Conway: *loc. cit.*

⁴ Grimm: *loc. cit.*, p. 1167.

had formed a second root in the ground was said to cure rheumatism. For the whooping-cough the child must be passed from side to side seven times, during the repetition of some mystic words which transferred the cough to the bramble. In Thuringia to be cured of the gout one must climb a young pine and tie in the topmost branch a knot, saying : "Pine, I bind here the gout that plagues me." Another method is to go three successive Fridays after sunset under a fir tree and say to it : "Fir tree, I complain to thee, the gout torments me sore."¹ A Flemish cure for ague directs the patient to go early in the morning to an old willow tree, and tie three knots in one of its branches, saying : "Good morning, old one, I give thee the cold, good morning, old one." A fever is transferred to the elder by saying : "Lift thee up, elder bough ! Antony's fire, sit on it now ! I've had thee a day, thou have it alway."² In the island of Carpathus the Greek priest ties a red thread around the sick person's neck. Next morning it is removed by friends and tied to a tree on the hillside.³ In some of the East Indian Islands epilepsy is treated by striking the sufferer on the face with leaves, which are then thrown away, the disease going with them. Toothache is believed in Northern Europe to be cured by sticking an elder-branch into the ground with the words : "Begone, bad spirit." Ague is cured in the same way, and the next person who comes to the spot gets it.⁴ In Oldenberg a remedy for toothache is to bore the tooth with a nail until it bleeds and then drive the nail into an oak where the sun will not shine on it.⁵ Another cure for ague is to make a gash in a lofty willow, breathe into it three times, and closing it quickly, hasten away without looking back.⁶ The evil spirit is thus breathed into the tree and there imprisoned—this superstition being doubtless an outgrowth of the idea of spirit and breath being one. Similarly, contact with holes in the trees, through which the spirits pass in and out, is a very effective treatment of various troubles.

Prominent in folk-medicine is the belief in the magic powers of trees and flowers. The underlying thought is still that of an indwelling spirit in the plant, the good-will and co-operation of which is secured by certain invocations and ceremonies. In the cure of diseases this beneficent spirit of the tree, embodied usually in the fruit or a branch, is powerful enough

¹ Grimm: *op. cit.*, p. 1170.

² *Ibid.*

³ *Blackwood's Magazine*, Feb., 1886.

⁴ Grimm: *loc. cit.*, p. 1170.

⁵ Couway: *loc. cit.*

⁶ Folkard, p. 98.

to drive out the evil spirit of the disease ; in the *prevention* of ills, the tree-spirit prohibits the entrance of the other. Thus elder is worn as a protection against epilepsy ; a juniper-plant bearing green berries along with ripe ones is effective against smallpox and witches ; in Russia the chestnut is efficacious for backache and gout ; the sap of dogwood, absorbed in a kerchief on St. John's eve, will fulfill all wishes ; grass blades confer second sight, and the sod from which they grow is a protection against witches ; inimical to witchcraft are also the elder, hazel, mistletoe and holly ; in Cornwall mountain-ash is carried as a charm against the evil eye, and as a cure for rheumatism ; a beverage prepared from the mistletoe was thought by the Druids to be a remedy against all poisons, and this same magic plant, representing the general spirit of vegetation, is highly favorable to fertility in human and animal species. The ancient Persians regarded it as a universal healer.¹ The Zufí Indians venerate a magical plant, the *Ténatsali*, which produces the most beautiful flowers of all colors, and is a cure for all ills.² The Bohemian poacher thinks he can make himself shot-proof by finding on St. John's Day pine cones on the top of a tree and eating one each day. It is a Suabian belief that the same result will be brought about by any one who on Friday of the full moon pulls up the amaranth and carries it folded in a white cloth against his breast.³ Scotch milkmaids wear mountain-ash charms as a protection against lightning, this custom originating in the resemblance of the red berries of the ash to the flowers of the sacred lightning-tree of the Hindoos.⁴ On the *Walpurgisnacht* German witches gather ferns to render themselves invisible.

In Cockayne's curious volumes on the *Leechdoms, Wort-cunning and Star-craft of Early England* are given many examples of the magic power of plants and trees. The juice of the Θεογγέλις, or gospel plant, was drunk by the magi before divination ; the γέλωτοφυλλῖς produced laughter ; the Θεῶν βρώτιον, food of the gods, kept the kings of Persia in health and vigor of mind ; another herb secured handsome and good children ; and Apollodorus knew a preparation that made fading love revive.⁵ He who sleeps under sacred trees receives in a dream such wisdom as leads to the restoration of his health.⁶ Sleeping beneath the boughs of the laurel, or on

¹ Bonwick : *Irish Druids and Old Irish Religions*, London, 1894, p. 236.

² Folkard, p. 109.

³ Dyer : *The Folk-Lore of Plants*, New York, 1889, p. 282.

⁴ Sara E. Wiltz : *Myths and Mother-Plays*, 1895, p. 31.

⁵ Cockayne, p. xiii.

⁶ Robertson Smith : *op. cit.*, p. 169.

mattresses composed of its leaves, brought prophetic visions and poetic inspiration.¹ The Sibyl who gave the answer of the god to those who sought counsel of the Delphian oracle, shook the sacred laurel, and sometimes ate the leaves, before becoming inspired. The Mandrake has always been thought to have a close and mysterious connection with human life, as may be seen even from its names, the English *Earthman*, German *Galgenmännchen* (gallows-man), Latin *Semihomo* (half-man), Greek *Anthropomorphon* (man-shape). It has always been supposed to possess supernatural powers, and to be the bearer of good fortune. It is still worn by the Greeks as a love-charm, and by many people is still believed, as it was by the Israelites 4,000 years ago, to be potent against sterility.

The sacredness of such plants and trees, that is, the power and good-will of the indwelling spirit, is the secret of their effectiveness as the bearers of good and preventers of evil. In view of this explanation one would expect to find plants whose magic powers produce illness or misfortune, since there are evil spirits in the vegetable world. This expectation is of course fulfilled, though the ill-disposed are found rather among herbs than trees, in accordance with the principle already deduced, that tree-spirits are on the whole beneficent.

VIII.

THE TREE IN CHILD LIFE.

If individual development is an abbreviated race-history, one should meet with some instructive parallels between primitive peoples and children, in their feelings towards nature. The returns to a syllabus sent out by President Hall in 1895, have made it possible to indicate with some assurance certain of these resemblances. That the notions and feelings of childhood are deeply tinged with animism there can be no question. Children ascribe to trees not only sentience, but intelligence, emotion, morality,—in a word, all the mental powers of which they themselves are possessed. To illustrate so general a statement, one must reproduce in some detail the child's feelings, as recorded by his elders, or by himself later in life.

That trees and flowers are believed to have physical feeling, and suffer when trimmed or cut down, is shown by replies which contain such phrases as these : Chopping down trees is cruel, for they feel pain as we do when injured ; shame to hurt trees so ; positive discomfort, at 18, to see trees trimmed ; seemed as if their arms and legs were being cut off ; disliked people who trimmed trees ; must hurt large trees to fall so far

¹ Folkard, p. 106.

when uprooted by storm ; sap oozing out is tree crying or bleeding ; when tree was felled it seemed like the loss of a friend.

The likeness in the child's mind between the tree and himself is seen to be very close, and worked out in detail : the limbs, trunk and roots are its arms and feet, the leaves are its clothing, the bark its skin, from which when bruised or cut the sap oozes as blood. Such myths as that of the Greek hamadryads, whose life-blood was seen to flow from the injured tree, are here revived in the child-consciousness. But this personification of trees, which is merely myth or poetry to adults, is serious philosophy to the child. The resulting feeling of sympathy for trees and flowers, and readiness to champion their cause with the thought of relieving their suffering, is a trait which may well be encouraged in the boy and girl. The fact of its having so solid a basis in instincts that are the out-growth of race history has probably contributed not a little to the success of Arbor Day.

The remarkable companionship and understanding between trees and children is illustrated by the confidence the children have that all this is appreciated by the trees : They like to have little boys and girls around ; make shade just for the children ; two big oaks watch over our house and take care of us ; spread their arms over us, like good mothers ; tree cried because lonesome ; get lonely if have not children to play around them. The birds and trees are close friends, and understand one another's needs and wishes : Birds the best playmates trees have, they sing so nicely and put the leaves to sleep, and the flowers ; trees glad when birds come back from South ; trees feel happy and honored when birds build nests in them ; try to stop the birds from going past, by holding out their hands to them.

A companionship between the trees themselves is many times mentioned. This includes a close sympathy and an understanding of one another's feelings and wishes. The interchange of thought through language sometimes extends only to trees of the same species, but oftener to all kinds : trees talk to each other just as people do ; they sometimes laugh loudly ; sympathize with one another when a branch is broken ; want to shake hands when they sway together ; love each other when they grow close together ; often say "good-night" to one another ; rustling of leaves is whispering of fairies who live in them ; wind blowing through branches is leaves singing their babies to sleep ; trees of same kind like to be planted next each other, for if an elm is planted near a maple it would be like putting an American girl with a little Dutch girl, and they would be lonely, not being able to understand. Trees can understand the children's talk, and the trees' language is usually intelligible to the child.

F., 6. Walking in woods, looked up suddenly to the leaves and said, "Oh, I am only going a little way." When asked to whom she was talking, replied, "Did n't you hear those leaves ask me where I was going?"

F., 10. When wind blows mournfully the leaves say, "I am sad, I am sad;" when branches snap they say, "I am mad, I am mad."

M., 4. "I love you, flowers, but you never say anything to me. When are you going to get old enough to walk and talk? Do you like me? Why don't you answer? You are the worst children I ever spoke to. I'll leave you all alone, and then you'll be afraid. Goodbye."

M., 10. Trees get angry at the wind, and scold and scream and slap it.

F., 5. Talks to trees by the hour, and understands their questions.

6-10. Favorite amusement of a group of children to sit under the trees and listen to the leaves tell stories.

The animism of childhood, which makes even the use of language possible between the child and the tree, surpasses even that of primitive peoples in the completeness with which the objects of nature are endowed with human attributes. Though animate nature had voices, yet they were rarely believed to be intelligible to man, except in such cases as the Greek oracles. It may be that the imagination of the civilized child is more active than that of the primitive adult, partly, perhaps, because the stimulus is more varied. But whatever the cause, the result can be turned to account by teacher and parent. If living thus close to nature brings the calmness of life and the sweetness of character, of which the poets tell us, it is surely worth our efforts to help the children retain their *naïve* attitude toward their world, by encouraging their direct contact with nature and by furnishing them with myth and legend to keep the actual from breaking in too early and too rudely upon them. Even for ourselves, if we are not too hopelessly past this stage, it might be a gain to throw off the artificiality and pettiness of life, and attempt to get back nearer to the heart of things and into closer harmony with the universe. Interpret the phrase as you will. To the Brahman it would mean something like the rest of Nirvana; to the every-day Christian, who sees the Creator in His works, it would be "peace in God;" to the philosopher it might be the feeling of comfort that he was catching a glimpse of the meaning of all things. From such moments we should go back to the world of men bearing some "sweetness and light," which, whatever be our philosophy of life, is a consummation to be wished.

The belief that living with the trees and the flowers has such an effect on character is supported by the careful observation of teachers, who are positive in their assurance that the children who do not believe trees to be alive and intelligent are the ones who lack the "finer feelings." A comparison of sexes as well

as of ages bears this out. The boy's nature is more apt to grow coarse than the girl's, and at an earlier age, and it is very noticeable that boys sooner than girls reach the period when they are ashamed of their animistic beliefs.

The sense of right and wrong is as evident as the intellectual endowments of trees. Some children think all trees and flowers good, but the consensus grants goodness only to those that are shady, or beautiful, or fruit-bearing, or that offer a protection to the birds. Those that are bitter, poisonous, prickly, unfragrant, or deceitful (*e. g.*, the candelabra making one believe it at a distance to be a water-lily), are accounted evil. This is a strongly utilitarian ethics, but has advanced beyond the egoistic stage. "Trees that cast no shadows are selfish," and selfishness is bad. This is a morality doubtless which has been already taught to the child, yet if he be a true representative of the race, he might in some measure, without instruction from elders, reach that standard, at the time when his life is epitomizing the stage of race-evolution which was no longer characterized by the fierce struggle for individual existence, but showed evidences of the higher struggle for the life of others.

The retribution which follows wrong doing is visited also upon the trees. Very often "crooked trees are bad ones, and God made them that way so that no one would love them."¹ In other cases crooked trees are merely unfortunate, and receive a great deal of sympathy. This difference of attitude may be largely due to the child's training, though partly to native kind-heartedness.

The feelings of reverence and worship in the child's heart it projects into the trees, finding analogies in the action. To them

"Nature with folded hands seems there
Kneeling at her evening prayer."²

F., 18. Once said after shower when everything was fresh: "How bright the flowers and trees are. They are looking up and thanking God for the rain. Don't you think so?"

F., 17. Thought the daisy was praying when it had its petals folded seemingly under its chin.

F., 11. Thinks God comes into the trees at times, out of the clouds when they touch the tree tops. All *white* flowers are angels.

M., 9. Wondered if the spirits of trees went to heaven.

M. The trees sing to the moon and stars.

F., 19. Flowers and leaves opened at night when they were kissed by the moon, which took all their tiredness away, and made them bright and happy.

¹ Among primitive myths it is common to find one in which the evil spirit made ugly and distorted trees while the great spirit was sleeping.

² Longfellow.

Social feelings and even conventionalities are not forgotten by the trees. They put on new dresses by changing color, get their dresses wet when it rains, put on green dresses because glad the birds are coming to build nests in branches, are ashamed when the leaves drop off.

The affection which children bestow upon the trees has been observed by every one, and need only be briefly sampled here:

M., 3. Can't pass a tree in his walks without putting his arms around it.

F. When 6 had been away for long visit, and when returning was so glad to see the big maples that she ran to each and hugged it, telling it how glad she was to see it again. Thought they, too, must have missed her, and been glad of her return.

F., 2. Used often to hug an old oak in the yard.

F., 18. When a child coming from play in the hot sun, would throw herself under the fine old tree in the yard and say, "you are a dear old tree for making it so cool here," and then jump up and give it an impetuous hug.

F., 6. When seen with her arms around a tree was told not to hurt it ; said, "I was n't hurting it; I was only loving it because it had no friends to play with and talk to."

This emotional expression, which is so genuine and unrestrained in childhood, assumes that the tree has the same feelings as the child is expressing toward it, and shows this side of the companionship to be as close as that in the realm of intellect and will. This thought, which the child carries through consistently, that nature is instinct with life and intelligence, with emotions and volitions, is more inspiring, it would seem, than the later mechanical conception of inert matter. Not that the child-consciousness need be a copy of the primitive mind, in which animistic conceptions were usually connected with many revolting ceremonies. These were not the result of animism. *It* accompanies undeveloped intellect; the grossness of the savage customs were the result of undeveloped morals. But intelligence and morality do not vary in direct ratio. A commendation of the results of an animistic conception of nature, therefore, does not involve an approval of the social life of savagery. Conditions are widely different for the child and for the early races of men, and not the least of these differences is that the child has leaders who can correct any tendencies to vice.

The assumption that practically all children believe trees to possess a psychic life similar to their own, may be questioned on the ground that only those who had such beliefs would reply to the questions circulated. But in point of fact teachers usually sent returns from all the members of their classes, regardless of the children's attitude toward the questions. Teachers, too, who have not sent individual returns report that of large classes of young children, every one thinks trees

to be "alive and able to feel and talk and love." Evidence is unquestioned, also, that such ideas have never been suggested to them. In homes, and indeed in whole neighborhoods, where the parents' lives, knowing little but daily drudgery, are hard and unpoetic in the last degree, the children have the same attitude toward the trees and flowers as in cultured homes, though the expression of such feeling would be met with but little encouragement. Under such conditions these feelings are more quickly smothered than though they could breathe an atmosphere of refinement and poetic appreciation.

The wide interests opened up to childhood by giving trees and flowers psychic life, and the depth and range of sympathy thus made not only possible but actual, as these returns show, place within reach of teacher and parent immense possibilities, in the line of the child's social and moral development; and an education which crowds out such feelings, or allows them to atrophy from disuse, is to be seriously questioned.

The influence of a great expanse of wood is distinct and peculiar. The feeling is described as one of awe, reverence, solemnity, and often a sense of peace. Children speak in hushed tones, walk as softly as possible, and even unconsciously restrain their breathing. The feeling of reverence is shown by such replies as:

M., 19. Ever since childhood entering a forest had a soothing influence. The denser the forest the more satisfied was he.

F., 17. Hushed and awed, and felt the peace that seemed to abide there. When in a deep forest feels as if she were a little thing in a great big world.

F., 6. Coming to deep woods dropped voice to a whisper, though previously talking quite loudly; when asked why, said "It feels like church."

F., 17. "A sweet sadness in forests that turned my thoughts toward God. Felt that I must be good there."

M., 4. When taken to park, after looking around at the trees and flowers asked if they might not sing "God is love."

In open fields the feeling is quite the opposite—one of exultant freedom. There is no restraint on feeling, and its expression is often the most boisterous. Children and even older boys and girls say they never felt so free as when in the fields; they like to run and tumble on the grass with perfect abandon, are always free to laugh and talk as much as they please, nothing is too loud there; even severe and dignified old men romp like little boys.

In fine gardens children enjoy the sight of the flowers, but have an "unfree" feeling. This, however, is chiefly the result of prohibitions regarding the flowers, and has not at all the same cause as the feelings inspired by the forest. The restraint

of the garden is artificial and the result of training, that of the forest is natural and the result of an instinct which grew up through many generations of forest life. We have sometimes been told that the impressive solemnity of the forest, which is illustrated by the children's feelings here recorded, was the cause of the ancients peopling the trees with spirits. But does not such an explanation begin at the wrong end? What is the cause of the solemnity? Why should the trees, merely as natural objects, cause such an awe? They may be beautiful and stately, they may be useful for shelter or shade, but a contemplation of them from these points of view would awaken no feelings of reverence. Nor would silence alone, nor the subdued light of the forest, bring the feelings of worship that are inspired at such a time. Darkness and quietude may cause fear but not reverence. At least after they have been allowed their full influence, there is still a residuum. If, then, external circumstances do not fully explain the feeling, the cause, or a part of it, must be elsewhere sought. We already have the clue. If the individual is recapitulating the history of the race, and if the race has passed through a very long period in which trees were worshipped and regarded as protecting spirits, then it is quite natural that there should linger, in the child, traces of a similar attitude toward the trees. Instead, therefore, of the forest being peopled with gods because of its mysterious impressiveness, it is mysteriously impressive because of having been formerly peopled by the gods, in the imagination of primitive man. Through the period of a few thousand generations during which the surest means of safety from enemies was flight into the trees, there would gradually grow up in the race an instinctive feeling toward the trees as natural protectors. Is not this feeling of *dependence* the very essence of religion?—or at least the origin of it, for we may not choose to call it religiou until it takes a more definite shape as *trust in a being*, or beings, who are believed to be powerful. Even as low down in the mental scale as the apes there doubtless is this feeling of safety, and an association of it with the tree; and, certainly, less developed intellect than the lowest races of mankind now possess would be sufficient for the harboring of thoughts toward the trees as beings strong enough to protect against enemies, and consequently sufficient for the beginnings of the same trust and humility which constitute the truest reverence in the highest races of to-day's civilization. Such an instinct, growing stronger for many centuries, and still in vigorous life among primitive tree-worshipping peoples, would of course show strong traces of survival, even in the most advanced races, and as a matter of fact the forest still has its influence over us in adult days.

If the tree-worshipping period was preceded, as already suggested in the section on tree-spirits, by a time in which even the beginnings of reverence were not possible,—a mere animal stage of development in which fear was the dominant emotion, and the forest was looked upon as only a place where wild beasts lurked,—we ought to find ontogenetic evidence of this. And many of the younger children do speak only of a feeling of fear, even when they are accompanied by their elders and the woods are known to harbor no wild animals. This feeling of fear decreases with age, as that of reverence grows—suggesting again that the race did pass through such stages in its religious evolution, though, of course, the reverence in its purest form still contains elements of fear.

The religious feeling here shown is not to be disregarded by the teacher. Children all too soon, in our present society, reach the persistently self-conscious stage, and this develops into our chronically homocentric attitude. If we believe this to be too narrow, here is our opportunity to broaden it. The feeling of reverence takes us out of self toward the infinite, and this *greatens* life. Littlenesses are left behind; there is no room here for sham. Whatever may be our particular beliefs the elements of religious feeling are the same, and they are present in such experiences, and give all subsequent life a greater meaning.

In addition to having particular trees to which they are devoted, and which frequently have a very special associational value, children usually have a favorite species of tree. The maple, pine and oak, are regarded with the greatest favor. The reasons for choices are various: some of them æsthetic, some practical, others purely animistic. Calling tallness, stateliness, gracefulness, evergreeness, beauty of leaves, rich coloring, etc., æsthetic qualities; making shade and fruit practical considerations; and classing all implied personifications—the bold strength of the oak, the tender sympathy of the pine, the sweet pathos of the willow—as animistic; we should probably find that æsthetic considerations lead, in the determination of favorite trees. The animistic conceptions, however, are more fundamental, and of wider range, even if not so frequently advanced as a reason for favoritism. Young children, moreover, are not able to analyze their likes and dislikes, and too much dependence is not to be placed in their replies on this point. Even if what they say can be accepted, what they leave unsaid cannot be determined. The young children, for instance, more frequently speak of the beauty or prettiness of the trees, while the older ones often mention the stateliness. We cannot conclude that therefore the young children have no

feeling of sublimity. The expression of it might be quite beyoud their power. With them the practical considerations are most easily expressed, and very frequently a tree is disliked because it bears no fruit. Boys sometimes dislike the pine-tree's "whine" and the "crying" of the willow. They are not so animistic and full of sentiment as the girls. There is probably in this a suggestion that the female mind, like the body, is more of a race-type than the male. It is true, also, that the boys' surroundings and work are likely to be more sternly practical than the girls'.

The frequent emotional characteristics attributed to trees, in cases where such attributes could hardly have been learned from an older person, suggest the appropriateness of plant language, and remind us of the universal use by man of "flowers for their charactery." Much of the symbolism of trees and flowers has a natural relation to some quality of the tree or flower—as the drooping willow expressing mourning, the clinging ivy as an emblem of fidelity, the trembling aspen as a type of fear, the whiteness of the lily suggesting purity. Not unfrequently, however, without any natural connection, some incident forms an association which is never lost; as in the case of the juniper representing protection, from Elijah's having been sheltered by it in his flight from Ahab; the sycamore denoting curiosity since the time of Zacchaeus; the olive as an emblem of peace, having been given to Judith when she restored peace to the Israelites, or possibly because of its connection with the oak; the linden denoting conjugal love, through its association with Philemon and Baucis; the rose as the universal symbol of love, connected with the story of Venus and Adonis. Sometimes a symbolic meaning is attached to a flower through a mere accident of language, as pansies, from the French *pensées*, thoughts.

The oak is about the only tree which is disliked by no one, so far as the children's verdict goes. It is admired for the beauty of its leaves, for its boldness, strength and noble bearing. The child's feelings may contain the suggestion of a reason why the oak, of all trees, held the most sacred place in earlier civilizations. It would be regarded as the most powerful spirit, with no unpleasant characteristics to detract from the feelings of reverence which it inspired.

The moral effect of the trees is worth emphasizing once more. Ruskin puts it strongly: "No one can be far wrong in either temper of mind or way of life who loves the trees enough," and Longfellow says

"The silent majesty of these deep woods
Shall uplift thy thoughts from earth;
As to the sunshine and the pure, bright air
Their tops the green trees lift."

IX.

THE TREE IN POETRY.

The personification of nature, so common and even so essential in poetry, is only a modernized form of animism, with some of the literalness removed from the meaning of the language. A century ago, when the relation between man and nature was less intimate than now, the nature-literature was artificial and lacked genuineness. The present poetic feeling of being "with nature's heart in tune," is well illustrated in Thoreau's companionship with her: "Every little pine needle expanded and swelled with sympathy, and befriended me. I was so distinctly made aware of the presence of something kindred to me, even in scenes which we are accustomed to call wild and dreary, and also that the nearest of blood to me, and humanest, was not a person nor a villager, that I thought no place could ever be strange to me again. . . . Why should I be lonely? Is not our planet in the Milky Way?"¹ Here is the beginning of that feeling of oneness with the universe which is in the very essence of great poetry. The influence of this feeling is none the less real because it cannot be expressed and only vaguely suggested. It is, in fact, because of the depth of this feeling that expression fails.

"There is a pleasure in the pathless woods,
There is a rapture on the lonely shore
To mingle with the universe and feel
What I can ne'er express, yet cannot all conceal."²

"Man is a part of creation and finds his own moral harmony in that of the universe. One must feel either love or religion in order to appreciate nature."³

"I have felt
A presence that disturbs me with the joy
Of elevated thoughts. . . . Therefore am I still
A lover of the meadows and the woods
And mountains; well pleased to recognize
In nature and the language of the sense
The anchor of my purest thoughts, the nurse,
The guide, the guardian of my heart, and soul
Of all my moral being."⁴

This feeling of affinity with nature has often taken definite shape in the metaphysical thought that if the smallest part of nature could be fully understood it would furnish a key to the secret of the universe:

"To see a world in a grain of sand
And a heaven in a wild flower."⁵

¹ *Walden*, London, 1886, pp. 130-1.

² Byrou.

³ Madame de Staél.

⁴ Wordsworth.

⁵ Blake.

"Little flower—if I could understand
 What you are, root and all, and all in all,
 I should know what God and man is."¹

The vague longing after the infinite, which the presence and companionship of nature brings to the heart, becomes a striving upward, a spiritual aspiration away from the narrowness of the actual. Even if we did not need the trees to warm our bodies, we should need them to warm our souls, says Dr. Bauer.

"Welcome, ye shades! Ye bowery thickets, hail!
 Ye lofty pines! ye venerable oaks!
 Ye ashes wild! resounding o'er the steep;
 Delicious is your shelter to the soul."²

"Go forth under the open sky, and list
 To nature's teachings."³

"There is a serene and settled majesty in woodland scenery, that enters into the soul, and delights and elevates it, and fills it with noble inclinations."⁴

"The tremendous unity of the pine absorbs and moulds the life of a race. . . . Whatever elements of imagination, or of warrior strength, or of domestic justice, were brought down by the Norwegian and the Goth against the dissoluteness or degradation of the south of Europe, were taught them under the green roofs and wild penetralia of the pine."⁵

To the Christian poet the upward leading of nature is a leading toward God :

"The meanest floweret of the vale,
 The simplest note that swells the gale,
 The common sun, the air, the skies,
 To him are opening Paradise."⁶

"There is a lesson in each flower,
 A story in each tree and bower;
 In every herb on which we tread
 Are written words, which, rightly read,
 Will lead us from earth's fragrant sod
 To hope, and holiness, and God."⁷

"There lives and works
 A soul in all things, and that soul is God. . . .
 Nature is but a name for an effect,
 Whose cause is God. . . . not a flower,
 But shows some touch in freckle, streak or stain
 Of His unrivalled pencil."⁸

¹ Tennyson.

² Thomson.

³ Bryant.

⁴ Irving.

⁵ Ruskin.

⁶ Gray.

⁷ Cunningham.

⁸ Cowper.

As a result of this nearness to the heart of nature there comes a soothing from care, a rest from the dust and the heat of the common-place day, an elevation of soul above trivialities, a noble purity born of great thoughts: "Children need, in their innocent up-springing, to have room to get away from the garish sun, and rest, as upon a mother's bosom, in the twilight silence of the growing woods."

"There is a quiet spirit in these woods
That dwells where'er the gentle south wind blows."¹

"As the leaves of the trees are said to absorb all noxious qualities of the air and to breathe forth a purer atmosphere, so it seems to me as if they drew from us all sordid and angry passions and breathed forth peace and philanthropy. There is something nobly simple and pure in a taste for the cultivation of forest trees. It argues a sweet and generous nature."²

"The presence of the love of nature is an invariable sign of goodness of heart and justness of moral perception; wherever the feeling exists it acts for good on the character to which it belongs."³

"The loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character by enfeebling the emotional part of our nature."⁴

These quotations are selected merely to illustrate, in a general way, the poets' feelings toward nature. The prose selections are poetic in spirit if not in form. The thesis is, that the poets, like the children, live close to nature and take her seriously, as a companion, capable of giving and receiving sympathy. This grows into the larger spirit of companionship with the universe, which calls forth the highest in the soul and gives a sense of harmony which is the deepest religious feeling and which produces a restfulness that is, or is akin to, the "peace of God, which passeth all understanding." It has already been suggested that the reason of this close relation between nature and spirit is to be found far back in primitive times when trees were worshipped as powerful and protecting spirits.

It remains to express my obligations to President Hall for the suggestion of this problem, for the use of the children's replies previously collected, and for much sympathy and encouragement throughout. To other members of the Clark Faculty also I am indebted for valuable references to literature.

¹ Longfellow.

² Irving.

³ Ruskin.

⁴ Darwin.

THE DYNAMOGENIC FACTORS IN PACEMAKING AND COMPETITION.

By NORMAN TRIPPLETT, Indiana University.

This paper gives some facts resulting from a study in dynamogenic stimulation carried on in the Psychological Laboratory of Indiana University and their application to explain the subject of Pacemaking and Competition.

The work has been done under the direction of Dr. W. L. Bryan and Dr. J. A. Bergstrom, to both of whom I am greatly indebted for the help rendered throughout its progress.

A copy of the official bicycle records made up to the close of the season of 1897 was obtained from the Racing Board of the League of American Wheelmen, and from these records certain facts are given, which, with the help of the chart showing the times made for certain distances by professionals in the three kinds of races principally dealt with, will make clearer the discussion following. The lower curve of the chart represents the record for the distances given in the unpaced efforts against time. The middle curve the paced race against time, and the upper curve the best time made in competition races with pacemaker.

The definition of these races may be given as follows: The unpaced race against time is an effort by a single individual to lower the established record. No pacemaker is used; the only stimulation of the rider being the idea of reducing his own or some other man's former time. The paced race against time is also a single effort to make a record. It differs only in the fact that a swift multicycle, such as a tandem or "quod" "makes the pace" for the rider. If he has well trained pacers and is skillful in changing crews as they come on, so as to avoid losing speed, the paced man may reduce the mark for the distance ridden. The two kinds of efforts described are not really races but are called so for convenience. Both are run with a flying start.

The third or paced competition race is a real race. Here, besides keeping up with the pacemaker, is the added element of beating the other contestants. No records are given for the unpaced competition race. This race will, however, be referred to in the course of this paper. It is often called a "loafing" race from the fact that the riders hang back and

try to make pacemakers of each other, well knowing that a contestant starting out to make the pace can not win.

VALUE TO BE GIVEN THESE RECORDS.

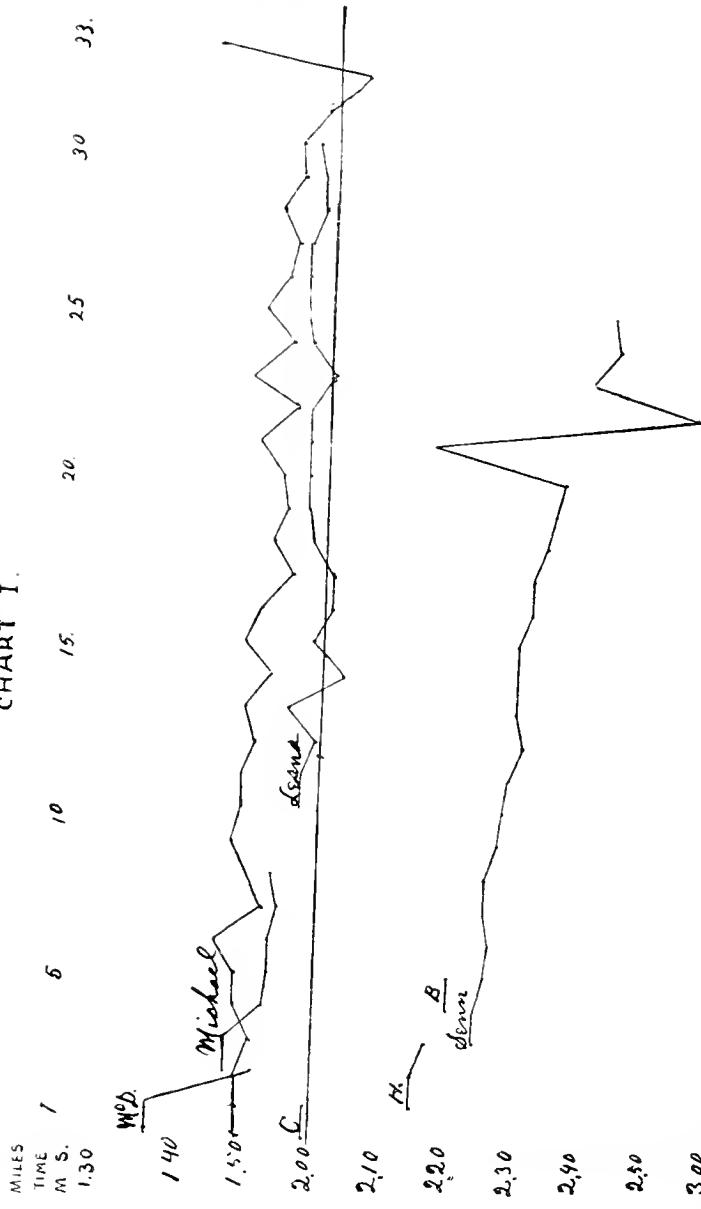
In presenting these records it is with the feeling that they have almost the force of a scientific experiment. There are, it is computed, over 2,000 racing wheelmen, all ambitious to make records. The figures as they stand to-day have been evolved from numberless contests, a few men making records which soon fall to some of the host who are pressing closely behind. Reductions now made, however, are in general small in amount. Were all the men engaged in racing to make an effort to reduce the time in the kinds of races named, it is probable that the records already made would stand or be but very little reduced while the present leaders and their closest competitors would again assert their superiority, each in his own style of race. Regarding the faster time of the paced races, as derived from the records, it may be asked whether the difference is due to pacing or to the kind of men who take part; and whether the argument ascribing the difference noted to pacing or competition should have less validity from the fact that different men hold the records in the different races. Men fast at one kind of racing are found to be comparatively slow at another. It is for this reason, perhaps, that Michael refuses to meet any one in an unpaced contest. The racer finds by experience that race in which he is best fitted to excel and specializes in that. The difference in time, therefore, between the paced and unpaced race, as shown by the records, is a measure of the difference between the experts in the two classes of racers. It seems probable that the same amount of difference exists relatively between the averages of the classes they represent. A striking practical proof that the difference between the paced and unpaced trials noted in the records is due to pacing, is found in the paced and unpaced time of some individual racers, given later, in which the difference in time corresponds closely to that of the records. The fact may be mentioned, too, that wheelmen themselves generally regard the value of a pace to be from 20 to 30 seconds in the mile.

DISCUSSION OF RECORDS.

Since the records of unpaced efforts against time, shown on the lower curve of the chart, are given only to 25 miles, comparisons with the other races are made for the same distance.

As is readily seen the time made here is much slower than in the paced race against time. The various factors advanced

CHART I.



Lower curve, unpaced — against time. Middle curve, paced — against time. Upper curve, paced competition race.

in explanation are given in detail in the following pages but the fact itself deserves attention at this point.

It has been stated that the value of a pace is believed by racing men to be worth to the racer from 20 to 30 seconds in the mile, depending on the individual. The difference between the paced and unpaced race against time is, it is seen from these figures, somewhat greater.

	Average time per mile.	Gain over unpaced.	Gain per cent. over unpaced.	Gain per cent. competition over paced.
	Min. Sec.	Sec.		
25 miles unpaced against time,	2 29.9			
" " paced "	1 55.5	34.4	22.9	
" " paced competition,	1 30.35	39.55	26.4	3.5

The paced record from the 3rd to the 10th mile inclusive, is held by Michael. His average gain per mile over Senn, the unpaced champion, is 34 seconds. From the 11th mile upward, a different man, Lesna, holds the paced records. Evidently the pace is not worth so much to him for his average gain per mile is only 29.7 seconds, and a portion of this apparent gain is really due to the increasing exhaustion of the unpaced man, Senn.

That the ability to follow a pace varies with the individual is well known. As a rule the rider who is fast with a pace is slow without it,—and the converse is believed to be true. This is the reason why the same man can never hold records in both paced and unpaced races. Walter Sanger is one of the fastest unpaced riders on the track, but he can ride only a few seconds better with the very best pacemakers, while Michael, whose ability as a "waiter" is almost marvellous, would fall a comparatively easy victim, his rivals think, in an unpaced race. Success in paced racing presupposes a well trained force of pacers. The last named rider has confessedly enjoyed greater advantages than his competitors in this respect.

The regularity with which he rides is seen in his paced record from 3 to 10 miles. His average rate for these 8 miles was 1 min. 53 sec. with a mean variation of less than .8 second. Other evidences of the constancy of the gain from a pace may be seen through all the records, the time for

20 miles professional, unpaced is	49 min.	20 sec.
25 " " paced "	49 "	8.4 "
20 " amateur, unpaced "	52 "	17 "
25 " " paced "	51 "	57.2 "
80 " professional, unpaced " 3 hr. 54 "	53 "	
100 " " paced " 3 " 52 "	14 "	

Showing in these cases a gain in favor of the pace of practically 25%. However, ratios between records made by different men, even though they are the product of many riders and entitled to great consideration, have not the absolute certainty

that the paced and unpaced time of the same man would have. Data on this point is difficult to obtain, however, as trackmen seldom follow both kinds of racing but specialize in that for which they are best fitted. The best times for one mile of two prominent racers who are good at both games have, however, been secured and are here given.

Arthur Gardiner, one mile, unpaced,	2 min. 3.8 sec.
" " " paced by 2 quods, 1 "	39.6 "
Earle Kiser, " " unpaced, 2 "	10 "
" " " paced, 1 "	42 "

The gain, in the case of the first, of the paced over the unpaced, is 24.2 seconds, nearly 20 per cent. The second gains 28 seconds, nearly 22 per cent., or within nine-tenths of one per cent. of the difference between the official paced and unpaced records made by different men.

Dr. E. B. Turner, F. R. C. S., England, in 1889, began a scientific study of the Physiology of Pacing and Waiting races, lasting over three years. He was a racing man himself and in his investigations made many tests on himself and others. Some figures showing the difference in time made by him at different distances, paced and unpaced, are given. In comparing them with the records of to-day it must be remembered that the wheel then used was heavy and fitted with cushion tires so that the time made in trials is slow as compared with the time made with the modern pneumatic wheel, and in consequence the value of the pace expressed in per cent., appears small. It is seen that as between distances paced and unpaced, his average gain per mile for the different trials varies all the way from 11.8 seconds to 20 seconds.

The upper curve of the chart shows the records made in paced competition races. Here, besides beating the record, the racer is intent on defeating his rivals. This race is started from the tape and in consequence is slightly slower for the first two or three miles than the time in the paced race against time with flying start. Thereafter the better time made witnesses to the power and lasting effect of the competitive stimulus. For 25 miles the time in this race averages 5.15 seconds per mile, or 3.5 per cent. faster than the paced race against time. From the 3rd to the 10th mile the same man, Michael,¹ holds the record in both races. His time in the competition miles averages over 5 seconds faster than his

¹ Since this article was written Michael's time in paced competition racing has been lowered. On June 17, 1898, E. A. McDuffie in his race with Taylor broke all records up to 30 miles. His time was 55:09 1-5, which is 1 min. 23 4-5 seconds faster than Michael's time for that distance. This increases the gain over the paced race against time to 8 seconds per mile.

TRIPPLETT:

Distance in Miles,	Details of Racing.	Time.		Gains for paced over unpaced trial.		Average gain per mile. Sec.	Per cent. gain
		Min.	Sec.	Min.	Sec.		
1	4 Pacemakers	2	37.6				
1	No " "	2	49.4				
3	5 "	8	6.6				
3	No " "	8	57.8				
3	No " "	9	7.	1	.4	17.	9.5
4	1 tandem "	11	31.				
4	No " "	12	2.4			20.	11.7
5	Several "	14	5.8				
5	" "	13	50.4				
5	No " "	15	23.8	1	.18	15.6	8.4
5	No " "	15	37.2	1	31.4	18.25	9.8
5	Alt. laps "	16	38.4	2	32.6	30.5	15.3
10	Several "	31	18.4				
10	No " "	33	17.2	1	58.8	11.8	6.
25	Numerous "	71	15.8				
25	Shared "	85	21.8	14	6.	36.	16.5
25	" "	81	16.4	10	.6	24.	

With tricycle.

paced miles against time. The fact that the same racing crews were used in both races suggests that in the latter race they also were responsive to the competition stimulus.

In his treatise on the "Physiology of Waiting and Pacemaking in Speed Competitions," Dr. Turner asserts that the causes operating to produce the differences noted between paced and unpaced races are directly due to the physiological effects of bodily and mental exercise. Stated briefly: the man who in a given distance does the greater amount of muscular work burns up the greater amount of tissue and in consequence his blood is more loaded with waste products and he excretes more urea and uric acid than the man who does a less amount in the same time. This excretion of nitrogenous products as shown by his experiments is directly proportional to the amount of work done. The blood, surcharged with the poisonous matter, benumbs the brain and diminishes its power to direct and stimulate the muscles, and the muscles themselves, bathed by the impure blood, lose largely their contractile power. He asserts further, that phosphoric acid is the principal product of brain work, and that carbonic acid, lactic acid and uric acid are excreted in greater quantities during brain work. Therefore, the man racing under conditions to produce brain worry will be most severely distressed.

The production of phosphoric acid by brain work is, however, in dispute. Some observers have found the phosphates diminished, whilst others have found them present in larger quantities during intellectual labor. As James says it is a hard problem from the fact that the only gauge of the amount is that obtained in excretions which represent other organs as well as the brain. Dr. Turner's tables of results bear him out, however, in the assertion that a less amount of waste matter was excreted on days when little or no exercise was taken, a greater amount when pacers were used, and the greatest amount when he made his own pace.

Basing his position on these physiological facts he states his thesis thus: "Given two men of equal calibre, properly trained and racing on a fair course, it is impossible (bar falls and similar accidents) for one of them to lead, make fast running and win the race; and the easier the track, the lighter and better the machines ridden, and the faster the time of the race—the longer the distance by which the one following will win." This is known by every rider and accounts for the "loafing" in unpaced competition races, as no man, unless decidedly superior to his competitors, dares to set the pace.

THEORIES ACCOUNTING FOR THE FASTER TIME OF PACED AND COMPETITION RACES.

Of the seven or eight not wholly distinct theories which have been advanced to account for the faster time made in paced as compared with unpaced competitive races and paced races against time as against unpaced races against time, a number need only be stated very briefly. They are grouped according to their nature and first are given two mechanical theories.

SUCTION THEORY.

Those holding to this as the explanation assert that the vacuum left behind the pacing machine draws the rider following, along with it. Anderson's ride of a mile a minute at Roodhouse, Ill., with the locomotive as pacemaker, is the strongest argument in its favor. Those maintaining this theory believe that the racer paced by a tandem is at a disadvantage as compared with the racer paced by a quod or a larger machine, as the suction exerted is not so powerful.

THE SHELTER THEORY.

This is closely related to the foregoing. Dr. Turner accepts it as a partial explanation of the aid to be gained from a pace, holding that the pacemaker or the leading competitor serves as a shelter from the wind, and that "a much greater amount of exertion, purely muscular, is required from a man to drive a machine when he is leading than when he is following, on account of the resistance of the air, and the greater the amount of wind blowing the greater the exertion, and conversely, the greater the shelter obtained the less the exertion."

This is the theory held, in general, by racers themselves. One of the champion riders of the country recently expressed this common view in a letter, as follows: "It is true that some very strong unpaced riders do not have any sort of success in paced racing. The only reason I can give for this is just simply that they have not studied the way to follow pace so as to be shielded from the wind. No matter which way it blows there is always a place where the man following pace can be out of the wind."

ENCOURAGEMENT THEORY.

The presence of a friend on the pacing machine to encourage and keep up the spirits of the rider is claimed to be of great help. The mental disposition has been long known to be of importance in racing as in other cases where energy is expended. It is still as true as in Virgil's time that the winners "can because they think they can."

THE BRAIN WORRY THEORY.

This theory shows why it is difficult for the leader in an unpaced competition race to win. For "a much greater amount of brain worry is incurred by making the pace than by waiting" (following). The man leading "is in a fidget the whole time whether he is going fast enough to exhaust his adversary; he is full of worry as to when that adversary means to commence his spurt; his nervous system is generally strung up, and at concert pitch, and his muscular and nervous efforts act and react on each other, producing an everincreasing exhaustion, which both dulls the impulse-giving power of the brain and the impulse-receiving or contractile power of the muscles."

THEORY OF HYPNOTIC SUGGESTIONS.

A curious theory, lately advanced, suggests the possibility that the strained attention given to the revolving wheel of the pacing machine in front produces a sort of hypnotism and that the accompanying muscular exaltation is the secret of the endurance shown by some long distance riders in paced races. Notice that Michael was able to make the last mile of his great 30 mile competition race the fastest of all and one of the fastest ever ridden.

THE AUTOMATIC THEORY.

This is also a factor which favors the waiting rider, and gives him a marked advantage. The leader, as has been noted, must use his brain to direct every movement of his muscles. As he becomes more distressed it requires a more intense exertion of will power to force his machine through the resisting air. On the other hand, the "waiter" rides automatically. He has nothing to do but hang on. "His brain having inaugurated the movement leaves it to the spinal cord to continue it and only resumes its functions when a change of direction or speed is necessary."—(Lagrange.) When he comes to the final spurt, his brain, assuming control again, imparts to the muscles a winning stimulus, while the continued brain work of the leader has brought great fatigue.

These facts seem to have a large foundation in truth. The lesser amount of fatigue incurred in paced trials is a matter of general knowledge. It is a common experience with wheelmen, and within that of the writer, that when following a lead on a long ride the feeling of automatic action becomes very pronounced, giving the sensation of a strong force pushing from behind. Of course the greater the distance ridden the more apparent becomes the saving in energy from automatic riding, as time is required to establish the movement. It may be remembered, in this connection, that while the average gain

of the paced over the unpaced record is 34.4 seconds, the difference between them for the first mile is only 23.8 seconds.

As between the pacer and the paced, every advantage seems to rest with the latter. The two mechanical factors of suction and shelter, so far as they are involved, assist the rider who follows. So the psychological theories, the stimulation from encouragement, the peculiar power induced by hypnotism, and the staying qualities of automatic action, if of help at all, directly benefit the paced rider. The element of disadvantage induced by brain action, on the contrary, belongs more especially to the rider who leads.

THE DYNAMOGENIC FACTORS.

The remaining factors to be discussed are those which the experiments on competition, detailed in the second part hereof, attempt to explain. No effort is made to weaken the force of the foregoing factors in accounting for the better time of paced races in comparison with unpaced races of the same type, but the facts of this study are given to throw whatever additional light they may.

This theory of competition holds that the bodily presence of another rider is a stimulus to the racer in arousing the competitive instinct; that another can thus be the means of releasing or freeing nervous energy for him that he cannot of himself release; and, further, that the sight of movement in that other by perhaps suggesting a higher rate of speed, is also an inspiration to greater effort. These are the factors that had their counterpart in the experimental study following; and it is along these lines that the facts determined are to find their interpretation.

OTHER FORMS OF RACING.

A few brief statements, mostly quoted from Dr. Turner's treatise, are given to show the value of a pacemaker in other forms of racing: "Foot racing differs from cycle racing in that it involves a much greater muscular effort. At each stride the whole body must be lifted and projected seven feet or more. The exertion is much the same whether the competitor makes his own pace or follows." So the "leader" and "waiter" commence their final spurt under more equal conditions than those which obtain in a cycle race, and a much smaller degree of superiority in the leading man enables him to run the spurt out of his opponent and win.

In ice skating the conditions are closely similar to those in wheel races, and a pacemaker is of nearly as much use as on the cycle track.

In a boat race the crews do not wait behind each other, but

struggle for the lead, and when they have obtained it "wait in front." The reasons for this are good:

(1) If a boat be clear in front it may take its opponent's water and wash it.

(2) The crew leading can see the others and regulate its pace accordingly.

(3) The actual physical labor involved in propelling a boat is very great, and therefore the laws of exercise already treated of apply.

(4) The length of a racing eight is 50 feet or more, and the time necessary to pass is too great to permit of waiting.

For similar reasons there is not the slightest advantage in waiting in a swimming race.

In horse racing a pacemaker is of use, but is not the overwhelming advantage it is in cycle racing. A good horse can run out an inferior, just as a good man can on foot; but in big races a stable companion is generally started to make running, when the favorite is a good stayer, in order that he may have a fast run race, without being put to the disadvantage of himself making the pace. This is especially true of distance races.

Kolb, from his study of the respiration and pulse curves resulting from a maximum effort in the various kinds of races, asserts that in cycling and skating, where great speed is attained by the use of special groups of muscles, it is the pulse rate that is largely increased, while in boat racing, running, wrestling and heavy gymnastics, the respiration is chiefly affected. If this claim is established it may furnish a reason why the pacemaker or competitor has greatest value in cycle and skating races. In these, where the ratio between power and speed is high, the outflow of nervous energy necessary in spurring has large expression. In the other class, while the energy made available by the competitive instinct, is probably the same, it is limited in its results by the respiratory need.

PART II.

From the laboratory competitions to be described, abstraction was made of nearly all the forces above outlined. In the 40 seconds the average trial lasted, no shelter from the wind was required, nor was any suction exerted, the only brain worry incident was that of maintaining a sufficiently high rate of speed to defeat the competitors. From the shortness of the time and nature of the case, generally, it is doubtful if any automatic movements could be established. On the other hand, the effort was intensely voluntary. It may be likened to the 100 yard dash — a sprint from beginning to end.

DESCRIPTION OF APPARATUS.

The apparatus for this study consisted of two fishing reels whose cranks turned in circles of one and three-fourths inches diameter. These were arranged on a Y shaped frame work clamped to the top of a heavy table, as shown in the cut. The sides of this frame work were spread sufficiently far apart to permit of two persons turning side by side. Bands of twisted silk cord ran over the well lacquered axes of the reels and were supported at C and D, two meters distant, by two small pulleys. The records were taken from the course A D. The other course B C being used merely for pacing or competition purposes. The wheel on the side from which the records were taken communicated the movement made to a recorder, the stylus of which traced a curve on the drum of a kymograph. The direction of this curve corresponded to the rate of turning, as the greater the speed the shorter and straighter the resulting line.

METHOD OF CONDUCTING THE EXPERIMENT.

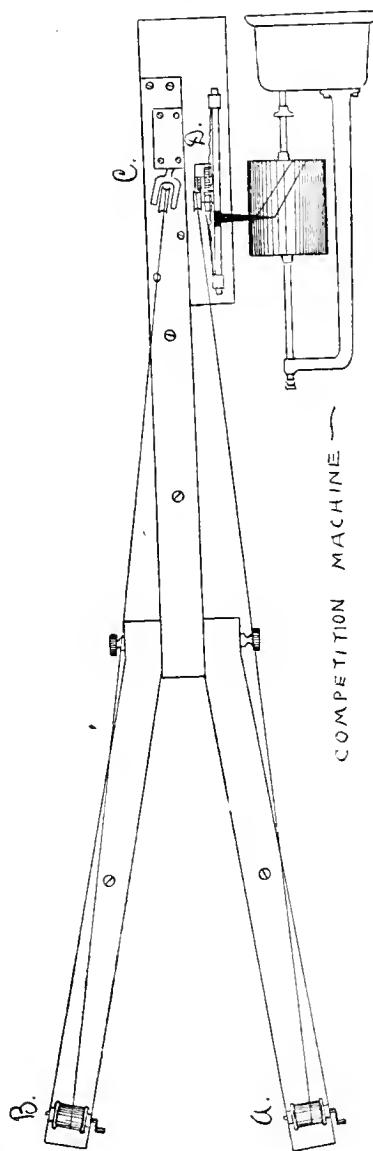
A subject taking the experiment was required to practice turning the reel until he had become accustomed to the machine. After a short period of rest the different trials were made with five-minute intervals between to obviate the possible effects of fatigue.

A trial consisted in turning the reel at the highest rate of speed until a small flag sewed to the silk band had made four circuits of the four-meter course. The time of the trial was taken by means of a stop-watch. The direction of the curves made on the drum likewise furnished graphic indications of the difference in time made between trials.

LIMITS OF ERROR.

Frequent trials of the machinery showed very small errors. In each regular trial the flag travelled 16 meters. For ten test trials the average number of turns of the reel necessary to send it over this course was found to be 149.87, with a mean variation of .15, showing that the silk band did not slip to any appreciable extent. If 40 seconds be taken as the average time of a trial (which is not far wrong), .15 of a turn will be made in .04 second.

Care was also exercised to have the kymograph maintain, so far as possible, a uniform rate of turning. When fully wound up it would run for nearly three hours. The actual running time in taking the six trials of a subject was about 4 minutes, or 40 seconds per trial. In testing, the drum was rotated during 4 minutes. The time necessary to repeat this amount of rotation was found, by trials, to be 4 minutes and



3 seconds, thus showing a retardation in each trial of about one-eightieth of the former trial as shown on the drum. The direct time of trials was taken with a stop-watch. It is from records thus taken that the tables given are composed. The drum curves, however, are important as giving a graphic representation of whatever changes occurred during the progress of the trial. The stylus, responding immediately to every change in rate of turning, gives clearly: indications of the force of competition, of the effects of adverse stimulation, fatigue, and other phenomena. The tendency of the retardation of the drum would be to diminish all these effects by one-eightieth—an amount not appreciable to the eye.

STATEMENT OF RESULTS.

In the course of the work the records of nearly 225 persons of all ages were taken. However, all the tables given below, and all statements made, unless otherwise specified, are based on the records of 40 children taken in the following manner: After the usual preliminaries of practice, six trials were made by each of 20 subjects in this order: first a trial alone, followed by a trial in competition, then another alone, and thus alternating through the six efforts, giving three trials alone and three in competition. Six trials were taken by 20 other children of about the same age, the order of trials in this case being the first trial alone, second alone, third a competition trial, fourth alone, fifth a competition, and sixth alone.

By this scheme, a trial of either sort, after the first one, by either of the two groups, always corresponds to a different trial by the opposite group. Further, when the subjects of the two groups come to their fourth and sixth trials, an equal amount of practice has been gained by an equal number of trials of the same kind. This fact should be remembered in any observation of the time made in trials by any group.

During the taking of the records, and afterwards in working them over, it was seen that all cases would fall into two classes:

First. Those stimulated—

- 1 to make faster time in competition trials,
- 2 in such a way as to inhibit motion.

Second. The small number who seemed little affected by the race.

The three tables which follow are made up from the records of the 40 subjects mentioned. The classification was in general determined by the time record as taken by the watch.

The first table gives the records of 20 subjects who, on the whole, were stimulated positively. The second table contains 10 records of subjects who were overstimulated. The third table shows the time of 10 subjects who give slight evidence of being stimulated.

The probable error used in the tables is that for a single observation: $r = .6745 - \sqrt{\frac{S^2}{n-1}}$. Its magnitude is large from the

nature of the case. To ascertain how large this should properly be, the individual differences of the subjects of Group A in Table I were eliminated in the following manner: The average of the six trials made by each subject was taken as most fairly representing him. With this as a basis the six trials were reduced to percentages—thus doing away with peculiarities due to age and disposition. By this means the probable errors of this group for the six trials in order were 2.57, 1.43, 1.81, 2.24, 1.11, 1.55. A similar reduction should be made in the probable error of all the tables.

In the tables, A represents a trial alone, C a trial in competition.

TABLE I.
Subjects Stimulated Positively.
GROUP A.

	Age.	A.	C.	A.	C.	A.	C.
Violet F.	10	54.4	42.6	45.2	41.	42.	46.
Anna P.	9	67.	57.	55.4	50.4	49.	44.8
Willie H.	12	37.8	38.8	43.	39.	37.2	33.4
Bessie V.	11	46.2	41.	39.	30.2	33.6	32.4
Howard C.	11	42.	36.4	39.	41.	37.8	34.
Mary M.	11	48.	44.8	52.	44.6	43.8	40.
Lois P.	11	53.	45.6	44.	40.	40.6	35.8
Inez K.	13	37.	35.	35.8	34.	34.	32.6
Harvey L.	9	49.	42.6	39.6	37.6	36.	35.
Lora F.	11	40.4	35.	33.	35.	30.2	29.
Average	11	47.48	41.88	42.6	39.28	38.42	36.3
P. E.		6.18	4.45	4.68	3.83	3.74	3.74
Gains			5.6	.72	3.32	.86	2.12

GROUP B.

	Age.	A.	A.	C.	A.	C.	A.
Stephen M.	13	51.2	50.	43.	41.8	39.8	41.2*
Mary W.	13	56.	53.	45.8	49.4	45.	43.*
Bertha A.	10	56.2	49.	48.	46.8	41.4	44.4
Clara L.	8	52.	44.	46.	45.6	44.	45.2
Helen M.	10	45.	45.6	35.8	46.2	40.	40.
Gracie W.	12	56.6	50.	42.	39.	40.2	41.4
Dona R.	15	34.	37.2	36.	41.4	37.	32.8
Pearl C.	13	43.	43.	40.	40.6	33.8	35.
Clyde G.	13	36.	35.	32.4	33.	31.	35.
Lucile W.	10	52.	50.	43.	44.	38.2	40.2
Average	11.7	48.2	45.68	41.2	42.78	39.	39.82
P. E.		5.6	4.	3.42	3.17	2.89	2.84
Gains			2.52	4.48	1.58	3.78	.82

* Left-handed.

TABLE II.
Subjects Stimulated Adversely.

GROUP A.

	Age.	A.	C.	A.	C.	A.	C.
Jack R.	9	44.2	44.	41.8	48.	44.2	41.
Helen F.	9	44.	51.	43.8	44.	43.	41.2
Emma P.	11	38.4	42.	37.	39.6	36.6	32.
Warner J.	11	41.6	43.6	43.4	43.	40.	38.
Genevieve M.	12	36.	36.	32.6	32.8	31.2	34.8
Average P. E.	10.4	40.84 2.41	43.32 3.57	39.72 3.25	41.48 3.85	39. 3.55	37.4 2.52

GROUP B.

	Age.	A.	A.	C.	A.	C.	A.
Hazel M.	11	38.	35.8	38.2	37.2	35.	42.
George B.	12	39.2	36.	37.6	34.2	36.	33.8
Mary B.	11	50.	46.	43.4	42.	48.	36.8
Carlisle B.	14	37.	35.4	35.	33.4	36.4	31.4
Eddie H.	11	31.2	29.2	27.6	27.	26.8	28.8
Average P. E.	11.8	39.08 4.61	36.48 4.07	36.36 3.89	34.76 3.71	34.4 5.33	34.56 3.45

TABLE III.
Subjects little affected by competition.

GROUP A.

	Age.	A.	C.	A.	C.	A.	C.
Albert P.	13	29.	28.	27.	29.	27.	28.6
Milfred V.	17	36.4	29.	29.4	30.2	30.2	32.2
Harry V.	12	32.	32.	32.6	32.6	32.6	31.6
Robt. H.	12	31.4	31.4	32.2	35.4	35.	32.4
John T.	11	30.2	30.8	32.8	30.6	32.8	31.8
Average P. E.	13	31.8 1.9	30.24 1.13	30.8 1.71	31.56 1.7	31.5 2.06	31.3 1.05

GROUP B.

	Age.	A.	A.	C.	A.	C.	A.
Lela T.	10	45.	37.4	36.8	36.	37.2	38.
Lura L.	11	42.	39.	38.	37.	37.	38.
Mollie A.	13	38.	30.	28.	30.	30.2	29.6
Anna F.	11	35.	31.8	32.4	30.	32.	30.4
Ora R.	14	37.2	30.	29.	27.8	28.4	26.8
Average P. E.	11.8	39.44 3.11	33.64 2.88	32.84 3.03	32.16 2.75	32.96 2.69	32.16 3.71

The 20 subjects given in Group A and Group B, of Table I, in nearly all cases make marked reductions in the competition trials. The averages show large gains in these trials and small gains or even losses for the succeeding trials alone. The second trial for Group A is a competition, for Group B a trial alone. The gain between the first and second trials of the first group is 5.6 seconds, between the first and second trials of the second group, 2.52 seconds. The latter represents the practice effect—always greatest in the first trials, the former the element of competition plus the practice. The third trial in Group A—a trial alone—is .72 seconds slower than the preceding race trial. The third trial in Group B—a competition—is 4.48 seconds faster than the preceding trial alone. The fourth trials in these two groups are on an equality, as regards practice, from an equal number of trials of the same kind. In the first case the gain over the preceding trial is 3.32 seconds. In the latter there is a loss of 1.58 seconds from the time of the preceding competition trial. In like manner there is an equality of conditions in regard to the sixth trial of these groups, and again the effect of competition plainly appears, the competition trial gaining 2.12 seconds, and the trial alone losing .82 seconds with respect to the preceding trial. These are decided differences. Curve No. 1 in Chart II is a graphical representation of them.

The 10 subjects whose records are given in Table II are of interest. With them stimulation brought a loss of control. In one or more of the competition trials of each subject in this group the time is very much slower than that made in the preceding trial alone. Most frequently this is true of the first trial in competition, but with some was characteristic of every race. In all, 14 of the 25 races run by this group were equal or slower than the preceding trial alone. This seems to be brought about in large measure by the mental attitude of the subject. An intense desire to win, for instance, often resulting in over-stimulation. Accompanying phenomena were labored breathing, flushed faces and a stiffening or contraction of the muscles of the arm. A number of young children of from 5 to 9 years, not included in our group of 40, exhibited the phenomena most strikingly, the rigidity of the arm preventing free movement and in some cases resulting in an almost total inhibition of movement. The effort to continue turning in these cases was by a swaying of the whole body.

This seems a most interesting fact and confirmatory of the probable order of development of the muscles as given by Dr. Hall and others. In the case of those sufficiently developed to have the fast forearm movement, fatigue or overstimulation seemed to bring a recurrence to the whole arm and shoulder

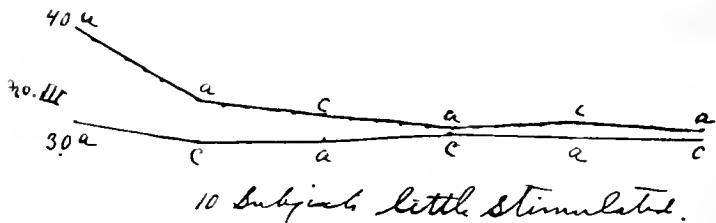
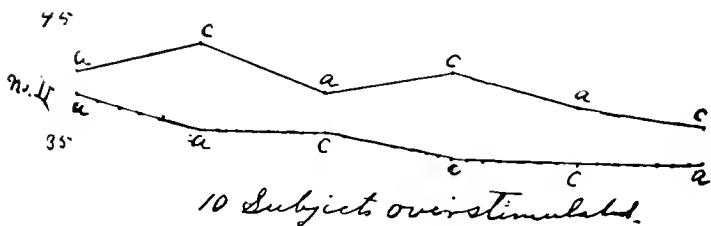
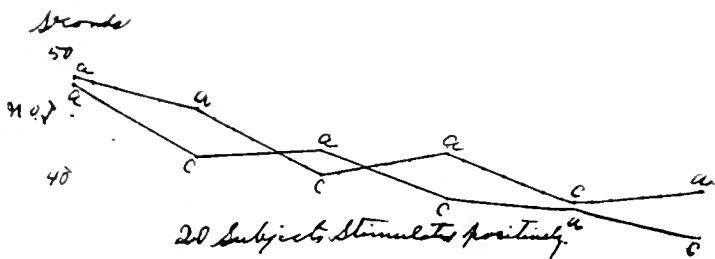


Chart II Solid line represents Group A
Dotted line represents Group B.

movement of early childhood, and if the fatigue or excitement was sufficiently intense, to the whole body movement, while younger children easily fell into the swaying movement when affected by either of the causes named.

It reminds one of the way in which fatigue of a small muscle used in ergographic work, will cause the subject to attempt to draw on his larger muscles, or, of the man who moves to

the city and acquires the upright carriage and springing step of the city-bred man, who, when greatly fatigued, insensibly falls into the old "clodhopper" gait. This tendency to revert to earlier movements and also old manners of speech, as Höpfner has shown in his "Fatigue of School Children," is common, when, for any reason, the centers of control are interfered with. It may be said, therefore, that in the work under consideration the chief difference between this group and the large group in Table I, was a difference in control; the stimulation inhibiting the proper function of the motor centers in the one case, and reinforcing it in the other. This, at least, seemed apparent from the characteristics exhibited by the two classes. Observation of the subjects of this class under trial, and careful scrutiny of their graphic records, show how decided gains were sometimes lost by the subject "going to pieces" at the critical point of the race, not being able to endure the nervous strain. Yet there exists no sharp line of division between subjects stimulated to make faster time and those affected in the opposite way. In some instances the nervous excitement acted adversely in every race trial, while in others, a gain in control, enabled the subject to make a material reduction in the last competition. A. B., one of three adults affected adversely, is an athletic young man, a fine tennis and hand-ball player, and known to be stimulated in contests of these kinds. It was noticed that in his competition trials time was lost because of his attempt to take advantage of the larger muscles of the arm and shoulder. After many trials and injunctions to avoid the movement he gained sufficient control to enable him to reduce the time in the competitions.

A. V., an adult of nervous organization, went half through his race with a great gain over his trial alone, but seeing his antagonist pushing him closely, broke down and lost the most of the gain made in the first half. The time of the trial alone was 38.6 seconds, that of the competition was 37.2 seconds. A comparison of the time in which the halves of the trials were made was computed in the following way: On the ordinate of the graph is measured the distance the stylus travels across the drum during 150 turns of the reel—the number in a trial. The distance on the abscissa between the ordinates running through the ends of the curve of any trial gives the time of the trial.

Parallel abscissas were drawn at the extremities of the curves, and a third one-half way between them. Half of the turns made in a trial were thus on each side of this middle line, and the times in which these turns were made were proportional to the segments of this line made by the curve intersecting it. By this means it was found that A. V. made the first

75 turns in his competition trial in 15 seconds, the second half in 22.2 seconds. By the same means, each half of the preceding trial alone was 19.3 seconds—an exception to the rule that the last half is slower because of fatigue.

Other curves when worked out in this way gave similar results. The time record, therefore, it must be seen, is not always a true index to the amount of stimulation present. Had the trials consisted of but half as many turns the effect of competition as it appears in the tables would have been shown much more constantly. Table II would have been a smaller group if indeed any necessity existed for retaining it.

A comparison of the time made by the different groups shows that the subjects of Table I are much slower than those of Table II, and that a still greater difference exists between this group and the subjects found in Table III. It may be said that they are slower because of greater sluggishness of disposition, and that the reductions made are largely a result of the subjects warming up. This, indeed, may be a part of the cause for it, but as the larger reductions coincide with the competition trials this cannot be held to completely account for it. A glance over the individual records discovers some facts which furnish a plausible partial explanation, when taken in connection with the following fact. The age at which children acquire control of the wrist movements, a large factor in turning the reel with speed, was found to be about 11 years in general, although a few of 9 and 10 years had this power. Now, of the 20 subjects composing Table I, 7 are 10 years of age or younger, while two others, age 13, are left-handed and being compelled to use the right hand are slow in consequence. So, here are 9 subjects, a number nearly equal to the group in Table II or Table III, who had a reason for being slow. Were these omitted from the count, the time of the initial trial would be found not to vary materially from that of Table II.

Besides the lack of muscular development of the younger subjects mentioned above, many of the subjects of Table I seemed not to have proper ideals of speed. The desire to beat, if it did nothing else, brought them to a sense of what was possible for them. The arousal of their competitive instincts and the idea of a faster movement, perhaps, in the contestant, induced greater concentration of energy.

The subjects in Table III, are a small group who seemed very little affected by competition. They made very fast time, but they are older than the average; their muscular control was good, and they had the forearm movements. Practice gains while somewhat apparent at first in some cases, are, as shown by curve No. 3 of the chart, on the whole, less in amount.

Their drum records show fewer fluctuations and irregularities, and less pronounced fatigue curves at the end.

There seems to be a striking analogy between these subjects and those racing men who are fast without a pace, but can do little or no better in a paced or competition race.

OBSERVATIONS ON THE WORK.

Energy Fluctuations. Among the many personal differences shown by the various subjects, nervous peculiarities were of great interest. A number exhibited the marked periodicity of energy discovered by Dr. Lombard, and described by him in the AMERICAN JOURNAL OF PSYCHOLOGY. It was especially prominent in the cases of L. P. and H. F., both bright children of an exceedingly nervous temperament, a rapid period being succeeded by one of apparent fatigue, thus alternating to the end of the trial. It was noticeable both in trials alone and in competition. In both subjects the phenomenon became less marked in the course of the trials. Both were much affected by the stimulation. The first making gains in her races, the second, almost helpless from nervous agitation in her first competition, does better in the second, and succeeds in making a substantial reduction in her third race, although a large part of the gain made in the first half of the trial is lost in the second.

Kolb in his "Physiology of Sport" asserts that in every physical contest involving a maximum effort there will be fluctuations of energy, and says that all oarsmen are familiar with the "hills" in the boat race, one being encountered in the second minute, the other at the end of the sixth minute. Long distance runners also experience the ebb and flow of strength markedly.

Effects from Age. It seems probable that one who is amenable to the stimulation of competition in childhood will be susceptible during his whole life; like the race horse that retains his desire to run long after the ability is lacking. The age at which the instinct develops was not ascertained. Two boys of 5 years possessed it to a marked degree. The one defeated in their race, according to his mother, felt badly about it all day. Adult subjects displayed the same differences of stimulation as in the case of children. It might be inferred from the records taken that the effect is greatest in early life and diminishes with advancing years. The practice effect, however, is greatest among the young, as they do not have the skill in the use of the hand that comes later. With adults, owing to their greater muscular control, practice counts for much less. So it was that the latter more surely made reductions in their competition trials, but smaller ones.

People differ greatly, as was noted, in the degree in which they are stimulated, but for the same individual it seems to be a constant force.

Two girls who were trained till the gain from practice was a small matter, in a ten days' trial showed remarkable uniformity in making reductions in their race trials. From the shortness of the period, in these cases, half the usual number of turns, and the skill acquired, the reductions were, however, small in amount. The averages for the ten days are as follows :

	a	c	a	c	a	c
Bessie V.	15.8	14.9	15.3	14.65	15.3	14.55
Helen F.	18.45	17.75	18.52	17.22	18.02	16.77

Each subject had 30 competitions. Out of this number the time for the first subject was reduced in 24 or four-fifths of the entire number. It was equal to the preceding trial in two cases. The second was faster in her race trials in 25 of the 30 or five-sixths of all, and in two cases equalled the preceding record. Of the three remaining trials, the pain from a blister on the hand caused one to be made in slower time.

In the race trials of the 40 subjects a portion of the reduction when made might in some cases be attributed to encouraging remarks. For instance, the racer would be told to "keep on, you are ahead," or "just one more round," in order to steady him. In the extended trial of the two subjects under discussion, however, some preliminary words to arouse the desire to beat were used, but after the start not a word was spoken. Whatever effect appeared was purely that of competition.

SEX DIFFERENCES.

Some small differences were found in the motor rate between the sexes, corresponding in general to the results exhibited in Dr. W. L. Bryan's study of "Motor Ability." For this grouping, the averages only for which are given, all cases were taken in which a trial alone was succeeded by a trial in competition.

At 10 years of age the boys begin faster than the girls, but both sexes are practically together on the competition trial. The greater speed of the boys, as Dr. Bryan has pointed out, is largely a result of their greater knack or skill in doing things, attributable to their more active life.

At 11 the boys are distinctly ahead, and, as noted before, a year's time has brought a large increase in speed, as at about this age a free use of the wrist movement is gained. At 12 the boys are slower than at 11, and have no advantage over the

With this table the mean variation was used.

TABLE IV.

Age.	MALES.			FEMALES		
	Cases.	A.	C.	Cases.	A.	C.
10	5	41.88	41.6	13	46.83	41.4
		4.34	5.52		3.76	2.98
11	14	35.76	34.36	25	40.3	37.89
		4.37	5.1		5.2	4.47
12	14	38.1	35.7	19	38.39	35.77
		3.92	2.75		6.11	4.
13	7	34.1	32.94	15	39.65	36.24
		7.13	4.81		5.3	5.1
Adults	45	31.35	29.	14	32.77	29.24
		3.17	3.29		2.8	2.56

girls. A difference appears again at 13 in favor of the boys. In the case of adults a slight margin of difference on the side of the males is seen.

As to the amount of stimulation the odds are apparently with the female sex. The proportion of girls influenced by competition is greater. Of the 40 subjects, 14 or 36.6 per cent. were boys, 26 or 63.4 per cent. were girls. In the group of those who were susceptible and influenced positively were 28.6 per cent. of the boys and 61.5 per cent. of the girls. In the group influenced negatively were 35.7 per cent. of the boys and 19.2 per cent. of the girls, and in the group not influenced 35.7 per cent. of the boys and 19.2 per cent. of the girls were found. These figures are deduced from the grouping made on the basis of the time record. An inspection of the graphs indicates that six in Table III were somewhat stimulated, although it is not made evident from the watch record. Were these subjects, consisting of 5 girls and 1 boy, to be transferred to their proper table the result would show that 100 per cent. of the girls and 71 per cent. of the boys showed stimulation.

The gross amount of the effect of competition is also greater in girls. When they were stimulated and had control they made greater gains than the boys and when over-stimulated their losses were greater than those made by the boys. The 16 girls of Table I gained the average sum of 10 seconds in their competition trials, while the four boys of this group gained an average sum of 8.15 seconds. In Table II the 5 girls lost 3 seconds each, in the course of their competition trials, while the 5 boys lost less than 1 second each.

INFLUENCES AFFECTING THE TIME OF SUCCEEDING TRIALS ALONE.

It is a well-known fact, that some wheelmen, who in private practice can go very fast, fail to distinguish themselves when

the real race is run in the presence of the public. The weakening effect of nervous agitation has been ascribed as the cause. On the other hand, Manouvrier, in his dynamometric studies found that this subject increased the energy of his movement when spectators were present. This is a common observation. The boy can turn better handsprings when wishing to impress the girls with a sense of his accomplishments. The football team play better ball under the stimulation of the home crowd. Other examples could be instanced showing how people respond to various social stimulations.

In the records of the 40 subjects found in the three groups discussed above, there are 80 cases wherein a competition trial is followed by a trial alone. Of these, 45 were made in faster time than the preceding competition trial. Several facts seem to contribute to this result.

First, greater facility in turning naturally follows from the practice gained in former trials. In general, spectators were not permitted during the trials alone, but in a few cases visitors were present. The effect of this would be to stimulate the subject in a trial alone. Then, too, the competition element entered into the trials alone and it was found advisable in some cases to keep from the subject the time made, as there was a constant desire to beat his own or his friend's records, and thus make all the trials competitive. The competition feeling seemed present all the time. It is felt, therefore, that succeeding trials alone are not really non-competitive trials.

In addition, the competition trial was a pattern for after trials, giving a higher ideal of speed and a hint of what was possible for the subject. Féré remarks that it was his own experience, and that of a majority of experimenters in dynamometrie, "that the second trial was in general stronger than the first, the first trial having the effect of reinforcing the idea of the movement." The same thing seems peculiarly true of the kind of work under discussion. The subject comes to a succeeding trial alone with a reinforced image of the movement. The over-excitement of the former race is gone, but somewhat of its stimulating effect, it may be, remains and in consequence more than half of the cases equal or exceed the former competitive trial.

PART III.

THE IDEA OF MOVEMENT.

We are led to believe that in the laboratory competitions detailed in Part II of this article, besides the bodily presence of a competitor, the idea of his movement, whether gained from sight or sound, had a stimulating effect on the racer. Some subjects followed with the eyes the course of the flags during the race and directed their exertions accordingly. Others seemed to be spurred on by the sound of the other machine, gaining some idea of the speed from the noise it made. Either seemed to possess equal power as a stimulus.

A favorite psychological principle with Féré, whose "*Sensation et Mouvement*" describes the most important work done in the field of Dynamogeny, is that "the energy of a movement is in proportion to the idea of that movement." He gives an experiment illustrating the subject as follows:

"If we ask the subject to look attentively at the movements of flexion, which we make with our hand, at the end of a few minutes he declares that he has the sensation of the same movement being made in his own hand, even though it may be entirely unmoved. And soon, indeed, his hand begins irresistibly to execute rhythmic movements of flexion. Or, if instead of letting the experiment come to this point, the subject is stopped at the moment where he commences to have the sensation of movement, and a dynamometer is placed in his hand, it is shown that the energy of his effort is increased one-fourth to one-half." Before the experiment the normal dynamometric force of the right hand was 23 kg., of the left, 15 kg. After seeing the experimenter make 20 flexions, the pressure for the subject's right hand was 46 kg., or double the former record. The left hand showed a slightly diminished force. An attempt was made to verify Féré's work with the ergograph. The subject was required to make maximum finger lifts corresponding to the beats of a metronome. After a series of lifts, the signal was given by the operator raising the index finger as if with the effort of lifting. Of 12 subjects tried, 8 made an increase when taking the time from the finger. The amount of increase seemed to be in proportion to the attention bestowed on the lifted finger of the operator. Two, who noticeably gave little attention to the straining of the finger except as a mere signal for lifting, made no gain whatever. Five maximum lifts of E. J., immediately preceding the substitution of the finger movement, averaged 17.2 millimeters in height, with a mean variation of .6 m. m. The first five efforts made at the sight of the finger movement averaged 19.1 m. m., mean variation .7 m. m., a

gain of 11 per cent. P. M. G., toward the end of an exhaustion curve, of which the last five lifts averaged 7.2 m. m., made five lifts, taking the cue from the finger, of an average height of 11.4 m. m., after which the energy of his efforts again began to decrease.

EFFECT OF A HIGHER RATE ON COUNTING.

An experiment on vocalization was made wherein a higher rate was suggested to the subject.

Ten subjects took the work described below on six successive days. Each was required to count aloud from 1 to 20 and repeat, as rapidly as articulation permitted, for 5 seconds. Three trials were made. The operator now counted at a faster rate and asked the subject to follow that rate. Three trials of this kind were made. This may be called Programme A.

Programme B differed from this merely in the one particular that the operator did no counting, but the three preliminary trials alone were followed instead by three similar trials alone—the intervals between trials, however, remaining the same.

Five subjects began with Programme A and five with Programme B, alternating each day, so that in the course of the six days each person had three experiences with each programme. The average sum counted by each subject during the series of trials is given below. Dividing by nine will give the average number counted in a single trial of that kind.

PROGRAMME A.				PROGRAMME B.		
Cases.	No. alone.	After a higher rate is given.	Gain.	No. alone.	Alone. No rate given.	Gain.
10	288.4	307.6	19.2	287.	288.5	1.5

The difference between the averages of the first two columns, 19.2, is the average gain of the ten subjects after they have had given them the idea of a faster rate of counting. Under this programme each individual makes a gain, under the other, where no higher rate is given, seven make smaller gains, three lose, and the average gain is but 1.5.

The principle of ideomotor action has wide application in human life. In the cases cited the observance of motion in another became a stimulus to greater effort. It may, however, have the opposite effect. A correspondence of rhythm of movement seems necessary to make it of aid. Two boys jumping together, or one following immediately at the sight of the other's jump, will not cover the distance possible in

jumping alone, because the swaying of the body, and swinging of the arms, not being synchronous or rhythmic become a distraction. So one soon becomes fatigued when walking with a person out of step.

CONCLUDING STATEMENT.

From the above facts regarding the laboratory races we infer that the bodily presence of another contestant participating simultaneously in the race serves to liberate latent energy not ordinarily available. This inference is further justified by the difference in time between the paced competition races and the paced races against time, amounting to an average of 5.15 seconds per mile up to 25 miles. The factors of shelter from the wind, encouragement, brain worry, hypnotic suggestion, and automatic movement, are common to both, while the competitors participate simultaneously in person only in the first.

In the next place the sight of the movements of the pacemakers or leading competitors, and the idea of higher speed, furnished by this or some other means, are probably in themselves dynamogenic factors of some consequence.

DARWIN'S IDEA OF MENTAL DEVELOPMENT.

By MARION HAMILTON CARTER.

INTRODUCTION.

In surveying the rise and progress of the Idea of Evolution, particularly since the publication of Darwin's "Origin of Species," in 1859, one can but be struck with its increasingly wide application to the interpretation of phenomena in every field of human inquiry. Starting with organic forms it has spread over both the world of living matter and the world of dead. Nay, more, it is now made to cover the facts of consciousness, and to serve as an explanation of the peculiarities of mind as well as of those of structure. Existence has come to be regarded, not as a bare fact, but as a continuing process in which there are known or determinable conditions followed by known or determinable results.

That the general concept of Evolution had been widely entertained previous to Darwin's day is beyond dispute, but it is to Darwin that we owe the definite and concrete form in which it has become potent in many new fields of investigation.

Inseparably bound up with the idea of organic evolution is the idea of mental evolution. *That* mind evolves seems to have been self-evident to Darwin, the case being granted at once upon its merits, and nowhere do we find him questioning it; *how* mind evolves he devoted a not inconsiderable portion of his work to showing; but he seems to have rested his problem on that assumption, for he tells us that "I have nothing to do with the origin of the mental powers, any more than I have with life itself. We are concerned only with the diversities of instinct and of the other mental faculties of animals of the same class."¹ And again, with regard to sensation, he says, "How a nerve comes to be sensitive to light hardly concerns us more than how life itself originated."²

Darwin accepted mind, as he accepted life itself, as part and parcel of his scheme of organic evolution; and he thought widely, though not deeply, upon it. He was emphatically neither psychologist nor metaphysician, and writes somewhat naively to John Fiske, of the "Outlines of Cosmic Philosophy": "I have long wished to know something about the views of the many great men whose doctrines you give. With

¹ *Origin of Species*, 6th ed., p. 242.

² *Ibid.*, p. 171.

the exception of special points I did not even understand H. Spencer's general doctrine. I never in my life read so lucid an expositor (and therefore thinker) as you are; and I think I understand nearly the whole—perhaps less clearly about Cosmic Theism and Causation than other parts. . . . It pleased me to find that here and there I had arrived from my own crude thoughts at some of the same conclusions with you, though I could seldom or never give my reasons for such conclusions."¹

It is not without some significance, particularly in an attempt to ascertain Darwin's exact philosophical standpoints, that this letter, mentioning special illumination, was not written until 1874, or eight years before his death, and after the great works of his life had been given to the world. His most mature thought upon psychological matters, or those bordering upon the psychological, is given to us in his work "On the Expression of the Emotions in Man and Animals." The earliest notes for this are dated 1838; the questionnaires from which he obtained much valuable information were sent out in 1867; but the book itself was not begun until Jan., 1871, the rough copy being finished in April of the same year.² It was published in 1873, or one year before the Fiske letter!

Final causes of things—ultimate realities—seem never to have troubled Darwin; doubtless they did not even come upon his horizon. On these subjects he held essentially the common sense views of the every-day man. He assumed out of hand that it was better to be an ape than an insect; that it was better to be a man than an Hottentot, and that it was better to be a civilized white man than a barbarian; and *progress* meant for him a movement in the direction of the civilized white man, with all that that entailed of intellectual and moral attainment, and not a movement in the direction of the insect. In the "Origin of Species" he writes:

"The degree of differentiation and specialization of the parts in organic beings, when arrived at maturity, is the best standard, as yet suggested, of their degree of perfection or highness. We have also seen that, as the specialization of parts is an advantage to each being, so natural selection will tend to render the organization of each being more specialized and perfect, and in this sense higher; not but that it may leave many creatures with simple and unimproved structures fitted for simple conditions of life, and in some cases will even degrade or simplify the organization, yet leaving such degraded beings better fitted for their new walks of life."³

¹ *Life and Letters*, Vol. II, p. 371.

² *Ibid.*, Vol. II, p. 313.

³ *Origin of Species*, p. 363.

His common sense view is again shown in his remarks on beauty.

"We can to a certain extent understand how it is that there is so much beauty throughout nature; for this may be largely attributed to the agency of selection. That beauty, according to our sense of it, is not universal, must be admitted by every one who will look at some venomous snakes, at some fishes, and at certain hideous bats with a distorted resemblance to the human face."¹

When, in 1859, Huxley spoke of Darwin as in the "front rank of British philosophers,"² we are to understand the term as then used to mean what is now generally called man of science rather than metaphysician. Much of Darwin's philosophical reading and thinking was evidently done late in life, if we may judge from his letters and the books he especially refers to in his later works, many of which were not published until the sixties and seventies; yet a very large part of his work was distinctly philosophical, *i. e.*, dealt with ultimate causal relations of phenomena and their laws, and one, at least, of his books may justly be regarded as a contribution to psychology. The problem before us now—Darwin's Idea of Mental Development—is biological in only the widest sense of the term.

In order to determine what his philosophical creed was, to see the conclusions he reached concerning consciousness and its place in a world-plan, it will be, perhaps, necessary to sum up the important questions presented by an evolutional view of mind, and discover how far he had both formulated and answered them. They are as follows:

I. Does mind come into the causal series of organic evolution at large? Is it actively concerned in progress, *i. e.*, has it a "survival value?"

II. If Darwin answers this question affirmatively, how does he define "mind?"

III. What is the relation of body, and, more particularly, of brain to mind?

IV. What evolves in "mental evolution"—mind, body, or both mind and body? If mind only, how can it influence organic evolution? If body only, how does its evolution carry with it the evolution of mind? If both, what is the course of "mental evolution?"

To these questions I shall endeavor to find answers in Darwin's own words, or (where he has left us no definite statements as to his views) give what he appears to have tacitly assumed or understood.

¹ *Origin of Species*, p. 488.

² T. H. Huxley: *Darwiniana; Essays*, 1894, p. 14.

CHAPTER I.

Does mind come into the causal series of organic evolution at large; is it actively concerned in progress, *i. e.*, has it a "survival value?"

To each clause of this question Darwin answers emphatically: "Yes." It is noteworthy, however, that he nowhere formulates, in definite terms, the problem of mind in the causal series of organic evolution, as distinct from the problems of mind's activity in progress and "survival value." What he had to say of mind in the one connection is inextricably interwoven with what he said of it in the others.

The story can be largely told in his own words, and is contained almost entirely in the "Descent of Man."

"Of the high importance of the intellectual faculties, there can be no doubt, for man mainly owes to them his predominant position in the world. We can see, that in the rudest state of society, the individuals who were the most sagacious, who invented and used the best weapons or traps, and who were best able to defend themselves, would rear the greatest number of offspring. The tribes which included the largest number of men thus endowed, would increase in number and supplant other tribes. Numbers depend primarily on the means of subsistence, and this depends partly on the physical nature of the country, but in a much higher degree on the arts which are there practised. . . . All that we know about savages, or may infer from their traditions show that from remotest times successful tribes have supplanted other tribes, and they succeed mainly, though not exclusively, through their arts, which are products of the intellect. It is, therefore, highly probable that with mankind the intellectual faculties have been mainly and gradually perfected through natural selection. . . . Now, if some one man in a tribe, more sagacious than the others, invented a new snare or weapon, or other means of attack or defence, the plainest self interest, without the assistance of much reasoning power, would prompt the other members to imitate him, and all would thus profit. . . . If the new invention were an important one the tribe would increase in number, spread and supplant other tribes."¹

"Man, in the rudest state in which he now exists, is the most dominant animal that has ever appeared on this earth. He has spread more widely than any other highly organized form; and all others have yielded before him. *He manifestly owes this immense superiority to his intellectual faculties*, to his social habits, which lead him to aid and defend his fellows, and to his corporal structure. *The supreme importance of these characters has been proved by the final arbitrament of the battle for life.* Through his powers of intellect, articulate language has been evolved; and on this his wonderful advancement has mainly depended. As Mr. Chauncey Wright remarks, 'a psychological analysis of the faculty of language shows, that even the smallest proficiency in it might require more brain

¹ *Descent*, new ed., pp. 128-9.

power than the greatest proficiency in any other direction.' He has invented and is able to use various weapons, tools, traps, etc., with which he defends himself, kills or catches prey, and otherwise obtains food. He has made rafts or canoes for fishing or crossing over to neighboring fertile islands. He has discovered the art of making fire, by which hard and stringy roots can be rendered digestible, and poisonous roots or herbs innocuous. This discovery of fire, probably the greatest ever made by man, excepting language, dates from before the dawn of history. These several inventions, by which man in the rudest state has become so pre-eminent, are the direct results of the development of his powers of observation, memory, curiosity, imagination and reason. I cannot therefore understand how it is that Mr. Wallace maintains, that 'natural selection could only have endowed the savage with a brain a little superior to that of an ape.'"¹

" . . . The intellect must have been all-important to him even at a very remote period, as enabling him to invent and use language, to make weapons, tools, traps, etc., whereby with the aid of his social habits he long ago became the most dominant of all living creatures."² . . . "But mere bodily strength and size would do little for victory, unless associated with courage, perseverance and determined energy."³

In a letter to Lyell we find these words: "I can see no difficulty in the most intellectual individuals of a species being continually selected; . . . the less intellectual races being exterminated."⁴

And compare the following:

"Obscure as is the problem of the advance of civilization, we can at least see that a nation which produced during a lengthened period the greatest number of highly intellectual, energetic, brave, patriotic and benevolent men, would generally prevail over less favored nations."⁵

In another letter, also to Lyell, he answers a case which seems at first sight contrary to his theories, *i. e.*, the stagnation and retrogression of the Greeks after having very high intellectual attainments.

"Thinking over . . . the high state of intellectual development of the old Grecians with little or no subsequent improvement, being an apparent difficulty, it has just occurred to me that in fact the case harmonizes perfectly with our views. . . . For in a state of anarchy, or despotism, or bad government, or after irruption of barbarism, force, strength or ferocity and not intellect would be apt to gain the day."⁶

In the passage which follows, Darwin carries to its logical conclusion his view of the importance of mind to progress.

¹ *Descent*, pp. 48-49. Italic mine.

² *Ibid.*, pp. 609-10.

³ *Ibid.*, p. 564.

⁴ *Life and Letters*, Vol. II, p. 7.

⁵ *Descent*, p. 142.

⁶ *Life and Letters*, Vol. II, pp. 88-9.

Not only does the individual mind serve the individual man in the struggle for existence, but the collective mind in a community is a necessity for common progress. He writes :

"The presence of a body of well instructed men, who have not to labor for their daily bread, is important to a degree which cannot be overestimated ; as all high intellectual work is carried on by them, and on such work material progress of all kinds mainly depends, not to mention other and higher advantages. . . . If in each grade of society the members were divided into two equal bodies, the one including the intellectually superior and the other the inferior, there can be little doubt that the former would succeed best in all occupations and rear the greater number of children."¹

The above quotations state clearly and fairly Darwin's case with regard to man ; but he held emphatically that mind in animals was, though in a less degree, still in the same relation to evolution as mind in man.

"In all changes," he tells us, "whether from persecution or convenience, intelligence must come into play in some degree. The kitty-wren (*I. vulgaris*), which builds in various situations, usually makes its nest to match with surrounding objects, but this is perhaps instinct."²

"Mr. Swinhoe attributes the victory of the common rat [in the struggle for existence] over the large *Mus conniga*, to its superior cunning."³

"The social instinct is indispensable to some animals, useful to still more, and apparently only pleasant to some few animals."⁴

"With those animals which were benefited by living in close association, the individuals which took pleasure in society would best escape various dangers ; whilst those that cared least for their comrades and lived solitary would perish in greater numbers."⁵

Particularly in his treatment of the evolution of the lower animals does he make a strong case for mind, stated under a quite new aspect. This is his work on "Sexual Selection :" for he makes sexual selection from first to last a psychical phenomenon, in the plainest sense of the word. Sexual selection means above all *choice*, and implies the feelings of love, jealousy, pleasure, disgust and dislike, to say nothing of the more distinctly intellectual attainments of observation and discrimination. In dealing with this, Darwin is everywhere explicit. He says, for instance :

"Sexual selection . . . has played an important part in the history of the organic world."⁶ "Secondary sexual characters . . .

¹ *Descent*, pp. 135-6; cf. the very definite statement on p. 49, and the parallel passages on pp. 93 and 617.

² Posthumous Essay on *Instinct*, in G. J. Romanes's *Mental Evolution in Animals*, p. 370.

³ *Descent*, p. 80.

⁴ *Instinct*, p. 381.

⁵ *Descent*, p. 105.

⁶ *Ibid.*, p. 613.

in the higher classes have been acquired through sexual selection, which depends on the will, desire and choice of either sex."¹ "As far as can be trusted, the conclusion is interesting that sexual selection, together with equal or nearly equal inheritance by both sexes, has indirectly determined the manner of nidification of whole groups of birds."²

In this last passage he declares that habit is indirectly determined, for a group of birds, by the *same agency*—sexual selection—which determines structure. It must be observed, however, that sexual selection cannot occur until some degree of intelligence has already been reached in the animal world. In a letter to F. Müller (Feb. 22, [1869?]), we find this :

"But what I want to know is, how low in the scale sexual differences occur which require some degree of self-consciousness in the males, as weapons by which they fight for the females, or ornaments which attract the opposite sex."³

Enough has now been quoted to show that Darwin returns an emphatic affirmative to the questions whether or not mind comes into the causal series of organic evolution at large, is actively concerned in progress, and has a survival value. We must now turn to our second question, and see what Darwin understood the term *mind* to cover.

CHAPTER II.

Unfortunately, we have to note, at the beginning of this Chapter, that Darwin failed to define his terms, and nowhere tells us in so many words what he meant to imply by "mind." After using the word for nearly a life-time, he remarks at the end of his work on Emotions,⁴ which was distinctly a contribution to psychology : "I have often felt much difficulty about the proper application of the terms, will, consciousness, and intention. Actions which were at first voluntary soon become habitual, and at last hereditary, and may then be performed even in opposition to the will."⁵

I propose here to give, briefly, what appear to have been his views, and to support my statements by the quotations which seem to prove my conclusions.

If a ball be struck, it will change its position, and move in the direction of the blow ; if a piece of ice be laid on a hot surface, it will change its form and condition, and melt ; if a drop of acid be placed upon the skin of a brainless frog, a leg is moved toward the acid which is, if possible, wiped away.

¹ *Descent*, p. 260.

² *Ibid.*, p. 456.

³ *Life and Letters*, Vol. II, p. 293.

⁴ This work was written about 8 years before his death.

⁵ *Emotions*, p. 357.

None of these actions are supposed to be accompanied by consciousness. Now I think that Darwin held distinctly that the movement of the leg of a brainless frog in response to the acid is of quite a different kind from the movement of the struck ball or melting ice; *it belongs to an entirely different category of phenomena from the phenomena of the merely mechanical causal series.* This is a statement somewhat difficult of proof; but the following sentence seems at least some small evidence in its favor.

"Reflex actions, in the strict sense of the term, are due to the excitement of a peripheral nerve, which transmits its influence to certain nerve-cells, and there in their turn excite certain muscles or glands into action; and all this may take place without any sensation or consciousness on our part, though often thus accompanied."¹

It is in reflex action, even though it "takes place without any sensation or consciousness," that we find the beginning of that *something* which later is called mind. Not that Darwin held that mind developed out of, or up from, reflex action, for I think the following passage shows that he did not:

"It is scarcely credible that the movements of a headless frog, when it wipes off a drop of acid or other object from its thigh, and which movements are so well co-ordinated for a special purpose, were not at first performed voluntarily, being afterwards rendered easy through long-continued habit so as, at last, to be performed unconsciously, or independently of the cerebral hemispheres."²

but reflex action seems to be the line of demarcation between the world of living matter and the world of dead, and is in some way *other than* the physical forces proper.

Higher than reflex action is instinct, and above instinct comes intelligence. Whether Darwin would have applied the term "mind" unconditionally to instinct is difficult to state, but from the general drift of his whole work it seems to me that, though he distinguished rather sharply between intelligence and instinct, he still held instinct to be in some way mind. Certainly he nowhere says it is not mind, even when he writes: "The very essence of an instinct is that it is followed independently of the reason."³ The following may make this clear:

"Water-hens and swans, which build in or near the water, will instinctively raise their nests as soon as they perceive the water begin to rise."⁴

He goes on to cite many cases of birds apparently choosing, selecting, and acting from habit and inheritance. He did not

¹ *Emotions*, p. 35.

² *Ibid.*, p. 40.

³ *Descent*, p. 122.

⁴ *Instinct*, p. 370.

think that intelligence was developed from instinct, for he says in a letter to Asa Gray, of April, 1860:

"The reviewer takes a strange view of *instinct*: he seems to regard intelligence as a developed instinct, which I believe to be wholly false. I suspect he has never much attended to instinct and the minds of animals, except by reading."¹

That animals had intelligence as well as instinct he firmly believed, though he did not consider the scope very wide, for he says quite emphatically (also in a letter to Gray): "The coolness with which he [Bowen] makes all animals to be destitute of reason is simply absurd."² (Nov. 26, 1860.)

And again, "only a few persons now dispute that animals possess some power of reasoning. Animals may constantly be seen to pause, deliberate and resolve."³

Regarding the mind of man he held simply that we have here a culmination,—a flowering,—for the whole series of organic species, but not something which differs in essence from the mind of the lower orders.

"The mental faculties of man and the lower animals do not differ in kind, though immensely in degree."⁴ "The fact that the lower animals are excited by the same emotions as ourselves is so well established, that it will not be necessary to weary the reader with many details."⁵ "As man possesses the same senses as the lower animals his fundamental intuitions must be the same."⁶

To the "high mental powers" of "abstraction, general conception, self-consciousness, mental individuality," he devotes a little over one page in the "*Descent of Man*." Here, if anywhere in his work, he shows how really little the meaning and value of his psychological terms had appealed to him. For instance, he attributes abstract ideas to some animals, and tells us that "when a dog sees another dog at a distance it is often clear that he perceives that it is a dog in the abstract [!]; for when he gets nearer his whole manner suddenly changes if the other dog be a friend."⁷

As I am to take up the development of instinct later, it will be enough here, in summing up this Chapter, to say that in a broad sense *mind* is used to cover all those attributes or powers of living beings, reasoning, abstraction, attention, self-consciousness, etc., which might be called "intelligence," and those actions and feelings which might be spoken of as "instinctive." These two, together with reflex action, Darwin included in a

¹ *Life and Letters*, Vol. II, p. 99.

² *Ibid.*, Vol. II, p. 146.

³ *Descent*, p. 75.

⁴ *Ibid.*, p. 147.

⁵ *Ibid.*, p. 69.

⁶ *Ibid.*, p. 66.

⁷ *Ibid.*, p. 83.

vague, unnamed, undefined group of manifestations differing essentially from the actions and reactions of the inorganic world. He treated intelligence, instinct and reflex action as phenomena of the same general kind, and showed that they were genetically related and subject to the same evolutional laws. It is my belief that he applied the term mind, or would have applied it had he given attention to his meanings and definitions in psychology, to every manifestation occurring in living matter to which any, even the most rudimentary form of consciousness could be ascribed, whether the animal manifesting it were a single cell or a complex organism; but that in general, he restricted it to what are called the "higher" mental faculties. In other words, he simply adopted the popular view of mind.

CHAPTER III.

A difficulty strikes us at the very outset of our inquiry into the relation of brain and mind, for Darwin used the two words almost interchangeably. He summed up his views when speaking of the change which came to him in his later life, through the loss of his aesthetic interests. He says:

" My mind seems to have become a kind of machine for grinding general laws out of large collections of facts, but why this should have caused the atrophy of that part of the brain alone on which the higher tastes depend, I cannot conceive. A man with a mind more highly organized or better constituted than mine would not, I suppose, have thus suffered, and if I had to live my life over again I would have made a rule to read some poetry and listen to some music at least once every week ; for perhaps the parts of my brain now atrophied would thus have been kept alive through use."¹

The discovery of the exact views held by Darwin on the relation of mind and brain is a task by no means easy. We have to remember that he never came to close quarters with his problem. That brain is the physical substrate of mind, and a particular brain of a particular mind, he never probably doubted, or even conceived the possibility of its being otherwise; but just what the relation of mind and brain implies, how it is effected, seems to have been equally remote to him. It strikes one with astonishment, in the midst of one's admiration for his stupendous tasks, his infinite care and his devotion to detail, to find this simplicity of view amounting almost to shallowness with regard to one of his fundamental problems,—a problem whose data he was continually collecting and collating, yet whose essence he seems to have missed to the last.

¹ *Life and Letters*, Vol. 1, pp. 81-82.

In his work on the "Expression of the Emotions" he devotes one of his longest, and in some ways, most critical chapters to *Blushing*, and gives a special section entitled, "The Nature of the Mental States which Induce Blushing."¹

"These consist of shyness, shame and modesty; the essential element in all being self-attention. Many reasons can be assigned for believing that originally self-attention directed to personal appearance in relation to the opinion of others was the exciting cause."

Then follow several pages of citations, and then the following:

"Finally, then, I conclude that blushing—whether due to shyness—to shame for real crime—to shame from a breach of the laws of etiquette—to modesty from humility—to modesty from indelicacy—depends in all cases on the same principle; this principle being a sensitive regard for the opinion, more particularly for the depreciation of others, primarily in relation to our personal appearance, especially of our faces; and secondarily, through the force of association and habit, in relation to the opinion of others on our conduct."²

Notice that he has given strictly psychological causes of blushing. His theory of it, somewhat condensed, I give in his own words; in it he sets forth, as clearly as anywhere in his works, his ideas on the relation of body and mind.

"The hypothesis which appears to me most probable, though it may at first seem rash, is that attention closely directed to any part of the body tends to interfere with the ordinary and tonic contraction of the small arteries of that part. These vessels, in consequence, become at such times more or less relaxed, and are instantly filled with arterial blood. This tendency will have been much strengthened, if frequent attention has been paid during many generations to the same part, owing to nerve-force readily flowing along accustomed channels, and by the power of inheritance. Whenever we believe that others are depreciating or even considering our personal appearance, our attention is vividly directed to the outer and visible parts of our bodies; and of all such parts we are most sensitive about our faces, as no doubt has been the case during many past generations. Therefore, assuming for the moment that the capillary vessels can be acted on by close attention, those of the face will have become eminently susceptible. Through the force of association the same effects will tend to follow whenever we think that others are considering or censuring our action or character. As the basis of this theory rests on mental attention having some power to influence the capillary circulation, it will be necessary to give a considerable body of details bearing more or less directly on the subject. Several observers [a note gives the authorities], who from their wide experience and knowledge are eminently capable of forming a sound judgment, are convinced that attention or consciousness (which latter term Sir H. Holland thinks the more explicit) concentrated on almost any part of the body produces some direct physical effect on it. This applies to the movements of the involuntary muscles, and of the voluntary

¹ *Emotions*, p. 326.

² *Ibid.*, p. 337.

muscles when acting involuntarily,—to the secretion of the glands,—to the activity of the senses and sensations,—and even to the nutrition of parts. [Then follow some cases which I omit.] Certain glands are much influenced by thinking of them, or of the conditions under which they have been habitually excited. This is familiar to every one in the increased flow of saliva, when the thought, for instance, of intensely acid fruit is kept before the mind. . . . We thus see that close attention certainly affects various parts and organs, which are not properly under the control of the will. By what means attention—perhaps the most wonderful of all the wondrous powers of the mind—is affected, is an extremely obscure subject. According to Müller (*Elements of Physiology*) the process by which the sensory cells of the brain are rendered, through the will, susceptible of receiving more intense and distinct impressions, is closely analogous to that by which the motor cells are excited to send nerve force to the voluntary muscles. . . . The manner in which the mind affects the vaso-motor system may be conceived in the following manner: When we actually taste sour fruit, an impression is sent through the gustatory nerves to a certain part of the sensorium; this transmits nerve force to the vaso-motor center, which consequently allows the muscular coats of the small arteries that permeate the salivary glands to relax. Hence more blood flows into the glands, and they secrete a copious supply of saliva. Now it does not seem an improbable assumption, that, when we reflect intently on a sensation, the same part of the sensorium, or a closely connected part of it, is brought into a state of activity, in the same manner as when we actually perceive the sensation. If so, the same cells in the brain will be excited, though perhaps in a less degree, by vividly thinking about a sour taste, as by perceiving it; and they will transmit in the one case as in the other nerve force to the vaso-motor center with the same results. . . . Now as men during endless generations have had their attention often and earnestly directed to their personal appearance, and especially to their faces, any incipient tendency in the facial capillaries to be thus affected will have become in the course of time greatly strengthened through the principles just referred to, namely: nerve force passing readily along accustomed channels, and inherited habit. Thus, as it appears to me, a plausible explanation is afforded of the leading phenomena connected with the act of blushing.”¹

I may pause here a moment to point out a concrete illustration of what I have called Darwin's simplicity of view almost amounting to shallowness; in this work he constantly uses (I believe for the first time, for I have failed to notice even one instance of it in his earlier works) the term “nerve force.” He speaks of the *undirected flow of nerve force*, and the *undirected overflow of nerve force*;² the *steady flow of nerve force*;³ the *involuntary transmission of nerve force*;⁴ *radiation of nerve force*,⁵ and *a thrill of nerve force*,⁶—yet nowhere does he make an attempt to tell us what this nerve force is, how it is related

¹ *Emotions*, pp. 337-344.

² *Ibid.*, pp. 32 and 349.

³ *Ibid.*, p. 71.

⁴ *Ibid.*, p. 68.

⁵ *Ibid.*, p. 41.

⁶ *Ibid.*, p. 197.

to or compares with other known physical forces; how it "flows," "overflows," "radiates" and "thrills," and, above all, what is its significance for consciousness. That it had significance for consciousness to his mind, will, I think, be evident from the context of two or three of the phrases quoted:

"The frantic and senseless actions of an enraged man may be attributed in part to the undirected flow of nerve force, and in part to the effects of habit."¹

"This involuntary transmission of nerve force may or may not be accompanied by consciousness. Why the irritation of a nerve cell should generate or liberate nerve force is not known, but that this is the case seems to be the conclusion arrived at by all the greatest physiologists."²

"On the other hand many of the effects due to the excitement of the nervous system seem quite independent of the flow of nerve force along the channels which have been rendered habitual by former exertions of the will; . . . for instance, the change of color in the hair from extreme terror or grief,—the cold sweat and the trembling of the muscles from fear."³

The above quotations bring out the point I made earlier, that Darwin had thought widely but not deeply upon psychological subjects, and that he never came to close quarters with some of his fundamental problems. He gives the facts clearly enough, but makes no attempt to reason them out to their legitimate conclusions. He tells us of nerve force producing action on the vaso-motor center, of undirected nerve force (in part) producing "frantic and senseless actions;" of an "involuntary transmission of nerve force" accompanied or not accompanied by consciousness; and last, but not least, of still other effects due to the *nervous system*, but *independent of nerve force*.

It may be urged that Darwin used the terms current in his day, which he obtained from the literature his quotations show him to have been familiar with. This, it seems to me, only emphasizes the fact that his psychology was at best second-hand, and that his contributions to philosophy did not lie in the exposition of the phenomena of consciousness in more than a superficial sense.

If Darwin did not define what he meant by nerve force, still less did he trouble himself with a clear statement of what he considered the exact relation of mind and brain to be. I have already quoted passages from his letters and works to show that he used the terms brain and mind interchangeably; I add one now, which occurs in the *Descent of Man*, and seems to me to carry more weight than the others:

¹ *Emotions*, p. 349.

² *Ibid.*, p. 71.

³ *Ibid.*, p. 50.

"As soon as the mental faculties had become highly developed, images of all past actions and motives would be incessantly passing through the brain of each individual. . . . As past impressions were compared during their incessant passage through the mind," etc.¹

In spite of these quotations it is difficult to believe that he considered the brain and mind as one and the same thing,—that the mind *is* the brain,—but I do think that he looked upon the mind as in the brain (he speaks of the "frontal part of the skull" as the seat of intellectual faculties)² in some way, and conditioned by it; yet at the same time he speaks of "the increased size of the *brain* from greater intellectual development,"³—indicating that the *brain* was, on the other hand, conditioned by the *mind*.

The further manner of the relation of brain and mind was by interaction. The substance of his theory of blushing is that we have a bodily action caused by a mental one, a psychic state causing a physical response. If his explanation leaves anything to be desired in explicitness it is offset by this passage, in which he states that the *mind* affects the heart.

"Hence when the *mind* is strongly excited, we might expect that it would instantly affect, in a direct manner, the heart; and this is universally acknowledged and felt to be the case. Claude Bernard also repeatedly insists, and this deserves special notice, that when the heart is affected it reacts on the *brain*; and the state of the brain again reacts through the pneumo-gastric nerve on the heart; so that under any excitement there will be much mutual action and reaction between these two most important organs of the body."⁴

"So a man may intensely hate another, but until his bodily frame is affected he cannot be said to be enraged."⁵

"He who gives way to violent gestures will increase his rage; he who does not control the signs of fear will experience fear in a greater degree; and he who remains passive when overwhelmed with grief loses his best chance of recovering elasticity of mind. These results follow partly from the intimate relation which exists between almost all the emotions and their outward manifestation; and partly from the direct influence of exertion on the heart, and consequently on the brain. Even the simulation of an emotion tends to arouse it in our minds."⁶

In the first of these quotations he states that *mind* acts on heart, and heart reacts on *brain*: but if we assume that "mind" was meant in the second instance, we can safely say that he commits himself to an interaction theory of mind and body.

¹ *Descent*, pp. 98 and 100.

² *Ibid.*, p. 55.

³ *Ibid.*, p. 197.

⁴ *Emotions*, pp. 68-9. Italics mine.

⁵ *Ibid.*, p. 240.

⁶ *Ibid.*, p. 366.

It is not impossible that he looked upon mind as a function of brain, though there is very little in his works to indicate this. In his book on the Emotions he quotes from Dr. Maudsley's "Body and Mind," in this passage :

"He adds, that as every human brain passes, in the course of its development, through the same stages as those occurring in the lower vertebrate animals, and as the *brain* of an idiot is in an arrested condition, we may presume that it '*will manifest its most primitive functions, and no higher functions.*'"¹

Still we must not lay too much stress upon this paragraph.

While we are dealing with the views which Darwin held upon the relation of mind and brain, it may not be without interest to note that he never seriously entertained the concept of mind as a *secretion of brain*,—in fact he does not even mention the theory. That it was familiar to him we may justly infer because he quotes frequently from the materialistic literature of the time,—Carl Vogt and others,—in which the subject was either treated or touched upon. The fact that he never thought it worth refuting would seem to indicate that the idea of brain and mind as two distinct yet interacting entities was too firmly grounded in him to admit the consideration of any rival theories. The expression he quotes from Maudsley about "brain manifesting its primitive functions," may have meant no more to him than "manifesting those conditions or states along with which, or under which, consciousness of various kinds occurs".

Taking, then, what he actually said about interaction of brain and mind, and what he failed to say about other theories, —mind as a function or as a secretion of brain,—we may state in answer to the question : How are mind and brain related? that Darwin postulated *two distinct, interacting interdependent realities, Mind and Brain.*

CHAPTER IV.

We come now to the main problem of our inquiry—what Darwin understood by Mental Development. We already have in hand some of our chief material. We have seen that Darwin held mind to be actively concerned in progress and causally related to organic evolution at large; that by mind he meant not only the higher faculties, but instinct, and that he considered the relation of mind to body to be one of interaction.

It is not in any way within the scope of this paper to show how, given Darwin's data for organic evolution, they would work out under any of the current theories of the relation of

¹ *Emotions*, p. 246. Italics mine.

brain and mind. Of these there are at least five: Interaction, Materialism, Spiritual Monism, Parallelism, and Logical-function Relation. (1) Interaction postulates two distinct beings, or entities, brain and mind, which, however, are related, and act and react upon each other. (2) Materialism assumes mind to be a product or function of the brain. (3) Spiritual Monism holds mind to be the only real, and body some form or product of it. (4) Parallelism regards mind and brain, and the changes of each, as corresponding series of phenomena. (5) Logical-function relation proposes "a relation between two terms (mind and brain), such that *if* the one term alters, *then* the second alters also."

Darwin's views on the causal relation of mind to organic evolution at large, its activity in progress, and its survival value, committed him to an interaction theory of mind and body for the particular organism; and he was thus, in a way, bound to a concept of mental development logically the outcome of these ideas. We should thus expect to find—and in fact we do find—that he regarded mental development as a *progressive series of mutual interdependencies* of mind and body, both for evolution at large and for the individual in particular.

Darwin never believed that materialism had said, or could say, the final word in the universe, and, consequently, never held that it could be the ultimate appeal in organic evolution. He was thus debarred from holding an opinion upon either the relation of mind to body at a given moment in time, or their relation through a series of moments, or indefinite time, which would cause mind to be solely and completely conditioned by matter, or, in other words, by its physical substrate, the brain.

Before trying to show what Darwin considered the developmental relation of the mental-bodily series to be, it will, perhaps, be best to give a short outline of his views on the evolution of one of the pair—the mental. Scattered through his books are numerous passages from which we may determine his general views, and, in particular, we have the posthumous essay on Instinct, intended once for the "Origin of Species," but omitted on account of its length and published finally in Romanes's work on "Mental Development." From these it is certain that Darwin held *mind to be subject to the same laws as body*. He tells us very little about mind in the sense of *intelligence*, but confines himself almost entirely to *instinct*.

I wish to show, in what follows, how he considered Instinct to have been governed and developed by the laws of variation, inheritance and natural selection,—the same laws by which the bodily structure of an organism is determined.

In one of his letters he says: "In my fuller MS. [probably

this posthumous essay] I have discussed a good many instincts, but there will surely be more unfilled gaps here than with corporeal structure, for we have no fossil instincts and I know scarcely any except of European animals."¹

If there were no "fossil instincts," he nevertheless "found some traces of a graduate series in instincts,"² which served a somewhat similar purpose; his chief emphasis is, however, on its survival value.

"An instinct, if really of no considerable importance in the struggle for life, could not be modified or formed through natural selection."³

"Instinct is for the preservation of the animal. . . . There is no valid reason why it should not have been acquired through natural selection, like corporeal structures used only on one occasion."⁴

"A complex instinct might have been acquired by successive steps and which, moreover, generally indicate according to our theory, the actual steps by which the instinct has been acquired, inasmuch as we suppose allied instincts to have branched off at different stages of descent from a common ancestor and therefore to have remained more or less unaltered, the instincts of the several lineal ancestral forms of any one species; bearing all this in mind, together with the certainty that instincts are as important to an animal as their generally correlated structures, and that in the struggle for life under changing conditions, slight modifications of instinct could hardly fail occasionally to be profitable to individuals, I can see no overwhelming difficulty in our theory."⁵

In another place he says: "He who admits on general grounds that the structure and habits of all animals have been gradually evolved, will look at the whole subject of Expression in a new and interesting light."⁶

Darwin even went so far as to speak of two instincts as struggling together, and in a letter of October, 1874, gives as an instance some of his early observations of ants which carried empty cocoons from a nest to the top of a tree, which he interpreted as a struggle of the instinct to remove an empty cocoon with the instinct to carry a cocoon. His words are: "One instinct [is] in contest with another and mistaken one."⁷ By this he evidently means the struggle of two instincts in the community, but not in the same individual; for some of the ants carried the empty cocoons up from the nest, and others, seeing these, carried them to a tree. He gives a more generalized case when he says: "There is a constant struggle

¹ *Life and Letters*, Vol. II, p. 34.

² *Instinct*, p. 378.

³ *Ibid.*, p. 378.

⁴ *Ibid.*, p. 377.

⁵ *Ibid.*, p. 330.

⁶ *Emotions*, p. 12.

⁷ *Life and Letters*, Vol. II, p. 370.

going on throughout nature between the instinct of the one to escape its enemy and of the other to capture its prey."¹

Perhaps the best short statement of his views is contained in one of his letters:

"Every one" (it reads) "who believes as I do that all *the corporeal and mental organs* (excepting those which are neither advantageous nor disadvantageous to the possessor) of all beings have been developed through natural selection, or the survival of the fittest together with use or habit, will admit that these organs have been formed so that their possessors may compete successfully with other beings and thus increase in number. Now an animal may be led to pursue that course of action which is most beneficial to the species by suffering, such as pain, hunger, thirst and fear; or by pleasure, as in eating and drinking and in the propagation of the species, or by both means combined, as in the search for food. . . . Hence, it has come to pass, that most or all sentient beings have been developed in such a manner, through natural selection, that pleasurable sensations serve as their habitual guides."²

Upon variation and inheritance he has much less to say than of the survival value of instinct; in one place he speaks of "*spontaneous variations* of instincts"³—a term which he commonly used in referring to structures; and a great many times he tells of changes in instinct. In another place he says: "I have endeavored in this chapter briefly to show that the mental qualities of our domestic animals vary and that the variations are inherited."⁴ Darwin seems to have had no doubt whatever upon the inheritability of something which makes for—if it be not yet—instinctive action.

"But in this case it is mental aptitude quite as much as bodily structure which appears to be inherited."⁵ "Gratiolet appears to overlook inherited habit."⁶ "Inherited like the tendency of a bulldog to pin the nose of a bull."⁷ "It further deserves notice that reflex actions are in all probability liable to slight variations, as are all corporeal structures and instincts, and any variations which would tend to be preserved and inherited. Thus reflex actions, when once gained for one purpose, might afterwards be modified independently of the will or habit, so as to serve some distinct purpose. Such cases would be parallel with those which, as we have every reason to believe, have occurred with many instincts; for although some instincts have been developed simply through long-continued and inherited habit, other highly complex ones have been developed through the preservation of variations of pre-existing instincts—that is through natural selection."⁸

Had Darwin said nothing more than the passages quoted,

¹ *Instinct*, p. 380.

² *Life and Letters*, Vol I, p. 280. Italics mine.

³ *Origin*, p. 244.

⁴ *Ibid.*, p. 275.

⁵ *Descent*, p. 33.

⁶ *Emotions*, p. 6.

⁷ *Life and Letters*, Vol. II, p. 421.

⁸ *Emotions*, p. 41.

his view of the continuity of the same laws through both structural and mental development would have been clear; but in this closing paragraph of his essay on "Instinct" he makes a statement which leaves us no doubt whatever:

"It may not be logical, but to imagination it is far more satisfactory to look at the young cuckoo ejecting its foster brothers, ants making slaves, the larvae of the Ichneumidae feeding within the live bodies of their prey, cats playing with mice, otters and cormorants with living fish, not as instincts specially given by the Creator, but as very small parts of one general law leading to the advancement of all organic bodies—Multiply, Vary, let the strongest live and the weakest Die."¹

Having seen how mind, or at least instinct, evolves, and that it is ruled by the same laws which govern the "advancement of all organic bodies," we may turn our attention more particularly to the questions which it is the purpose of this Chapter to discuss, and, if possible, to answer.

"What evolves in mental evolution, mind or body?" To this Darwin undoubtedly replied: "*Both evolve.*" I have already shown that he looked upon *mind*, instinct, as evolving, and as being subject to one and the same law of organic development; a concept of mind which might almost imply spiritual monism or identity, but which to him seems to have been proof of interaction. On the other hand, a great part of his life's work was devoted to showing how structure, and consequently brain, evolve; a concept which would imply a conditioning of the psychic life by its physical substrate. That the psychic was in his opinion conditioned by, and to a large extent dependent on the physical, we may show by his own very specific statements.

"Although we learn from the above-mentioned insects, and the beaver, a high degree of intelligence is certainly compatible with complex instincts, and although actions, at first learnt voluntarily, can soon, through habit, be performed with the quickness and certainty of reflex action, yet it is not improbable that there is a certain amount of interference between the development of free intelligence and of instinct,—which latter implies some inherited modification of the brain. Little is known about the functions of the brain, but we can perceive that as the intellectual powers become highly developed, the various parts of the brain must be connected by very intricate channels of the freest intercommunication; and, as a consequence, each separate part would perhaps tend to be less well fitted to answer to particular sensations or associations in a definite and inherited—that is instinctive—manner. There seems even to exist some relation between a low degree of intelligence and a strong tendency to the formation of fixed, though not inherited habits; for, as a sagacious physician remarked to me, persons who are slightly imbecile, tend to act in everything by routine or habit; and they are rendered much happier if this is encouraged."²

¹ *Instinct*, p. 384.

² *Descent*, p. 68.

And again : "That some physical change is produced in the nerve-cells or nerves which are habitually used can hardly be doubted, for otherwise it is impossible to understand how the tendency to certain acquired movements is inherited."¹

The passage which I now give, and which might properly have been inserted in the Chapter on "Mind in the Causal Series," leaves no room for doubt as to Darwin's opinion of the dependence of mind upon the development of the brain ; but more than that, it leaves equally no doubt of the dependence of structure—at least in evolution through a series,—upon the "exertion of choice," a purely psychic phenomenon.

"He who admits the principle of *sexual selection* will be led to the remarkable conclusion that the *nervous system not only regulates most of the existing functions of the body, but has indirectly influenced the progressive development of various bodily structures and of certain mental qualities*. Courage, pugnacity, perseverance, strength and size of body, weapons of all kinds, musical organs, both vocal and instrumental, bright colors and ornamental appendages have all been indirectly gained by one sex or the other, through the exertion of choice, the influence of love and jealousy, and the appreciation of the beautiful in sound, color or form ; and these powers of mind manifestly depend on the development of brain."²

It may not be out of place to notice that while these words (and others which I have given) indicate an interaction and interdependence in the developmental series, they do not imply a reciprocal action. The powers of mind seem to depend upon the condition of the brain of a particular individual at a particular moment, each change in which subtends a corresponding psychic change ; while on the other hand, the "exertion of choice"—in sexual selection—works no appreciable change upon the particular organism, does not in any way modify its structure, or have application to it in point of time, but operates upon the series as a whole. In other words, mind depends immediately on what brain *is* at a given moment, but structure depends meditately on what mind *has been* at a given moment. Darwin does not state this in so many words, but the conclusion seems obvious from the data given. This does not in any way interfere with the concept of mutual interdependence in development, as the following letter to Lyell (June 6 [1860]) will show :

"I suppose Lowell's difficulty about instinct is the same as Bowen's, but it seems to me wholly to rest on the assumption that instincts cannot graduate as finely as structures. I have stated in my volume that it is hardly possible to know which, *i. e.*, whether instinct, or structure, change first by insensible steps. Probably sometimes instinct, sometimes structure. When a British insect feeds on an exotic plant, instinct has changed by very small steps, and their structures

¹ *Emotions*, p. 29.

² *Descent*, p. 617. Italics mine.

might change so as to fully profit by the new food. Or, structure might change first, as the direction of tusks in one variety of Indian elephants, which leads it to attack the tiger in a different manner from other kinds of elephants.¹

"As the various mental faculties gradually developed themselves the brain would almost certainly become larger. No one, I presume, doubts that the large proportion which the size of man's brain bears to his body is closely connected with his higher mental powers. We meet with closely analogous facts with insects; for in ants the cerebral ganglia are of extraordinary dimensions, and in all the Hymenoptera these ganglia are many times larger than in the less intelligent orders, such as beetles. On the other hand, no one supposes that intellect of any two animals or of any two men can be accurately gauged by the cubic contents of their skulls. It is certain that there may be extraordinary mental activity with an extremely small absolute mass of nervous matter; thus the wonderfully diversified instincts, mental powers, and affections of ants are notorious, yet their cerebral ganglia are not so large as the quarter of a small pin's head. Under this point of view, the brain of an ant is one of the most marvellous atoms of matter in the world, perhaps more so than the brain of a man.

The belief that there exists in man some close relation between the size of the brain and the development of the intellectual faculties, is supported by the comparison of the skulls of savage and civilized races, of ancient and modern people, and by the analogy of the whole vertebrate series. Dr. J. Barnard Davis has proved, by many careful measurements, that the mean internal capacity of skull of Europeans is 92.3 cubic inches; in Americans 87.5; in Asiatics 87.1; and in Australians only 81.9 cubic inches. Prof. Broca found that the 19th century skulls from graves in Paris were larger than those from vaults of the twelfth century, in the proportion of 1484 to 1426; and that the increased size, as ascertained by measurements, was exclusively in the frontal part of the skull—the seat of the intellectual faculties. Prichard is persuaded that the present inhabitants of Britain have "much more capacious brain cases" than the ancient inhabitants. Nevertheless it must be admitted that some skulls of very high antiquity, such as the famous one of Neanderthal, are well developed and capacious. With respect to the lower animals, M. E. Sartet, by comparing the crania of tertiary and recent mammals belonging to the same groups, has come to the remarkable conclusion that the brain is generally larger and the convolutions are more complex in the more recent forms. On the other hand, I have shown that the brains of domestic rabbits are considerably reduced in bulk, in comparison with those of the wild rabbit or hare; and this may be attributed to their having been closely confined during many generations, so that they have exerted their intellect, instincts, senses and voluntary movements but little.

The gradually increasing weight of the brain and skull in man must have influenced the development of the supporting spinal column, more especially whilst he was becoming erect. As this change of position was being brought about, the internal pressure of the brain will also have influenced the form of the skull; for many facts show how easily the skull is thus affected. . . . Lastly, if any animal were to increase or diminish much in general size, without any change in its mental powers, or if the mental powers were to be much increased or diminished, without any great change in the size of the

¹ *Life and Letters*, Vol. II, pp. 111, 112.

body, the shape of the skull would almost certainly be altered. . . . From these several facts we can understand, to a certain extent, the means by which the great size and more or less rounded form of the skull have been acquired by man; and these are characters eminently distinctive of him in comparison with the lower animals."¹

These passages state, it seems to me, with adequate clearness that Darwin considered the development of any brain in the animal series to be closely correlated with the degree of intelligence manifested. Darwin held that not only was there a progressive series of minds, but that those minds had been derived, the one from the other, by the natural processes of inheritance and modification of the total organism, and that a common progenitor for mind was *given with or in* the common progenitor for body. By this means he accounts for the similarity of taste, feeling, emotion, etc., which he notes as existing throughout the animal kingdom.

"To maintain independently of any direct evidence that no animal during the course of ages has progressed in intellect or other mental faculties is to beg the question of the evolution of species. We have seen that according to Sartet, existing mammals belonging to several orders have larger brains than their ancient tertiary prototypes."²

"Every one who admits the principle of evolution, and yet feels great difficulty in admitting that female mammals, birds, reptiles and fish, could have acquired the high taste implied by the beauty of the males, and who generally coincide with our own standard, should reflect that the *nerve cells of the brain in the highest as well as in the lowest members of the vertebrate series, are derived from those of the common progenitor of this great kingdom.* For we can thus see how it came to pass that certain mental faculties, in various and widely distinct groups of animals, have been developed in nearly the same manner and to nearly the same degree."³

"If no organic being excepting man had possessed any mental power, or if his powers had been of a wholly different nature from those of the lower animals, then we should never have been able to convince ourselves that *our high faculties had been gradually developed.* But it can be shown that there is no fundamental difference of this kind. We must admit that there is a much wider interval in mental power between one of the lowest fishes, as a lamprey or lancelet, and one of the higher apes, than between an ape and a man; yet this interval is filled up by numberless gradations.

Nor is the difference slight in moral disposition between a barbarian, such as the man described by the old navigator Byron, who dashed his child on the rocks for dropping a basket of sea-urchins, and a Howard or Clarkson; and in intellect, between a savage who uses hardly any abstract terms, and a Newton or Shakespeare. Differences of this kind between the highest men of the highest races and the lowest savages are connected by the finest gradations."⁴

"As far as I understand your remarks and illustrations, you doubt

¹ *Descent*, pp. 54-6. Italics mine.

² *Ibid.*, p. 81.

³ *Ibid.*, pp. 616-17. Italics mine.

⁴ *Ibid.*, pp. 65-6. Italics mine.

the possibility of gradations of intellectual powers. Now, it seems to me, looking to existing animals alone, that we have a very fine gradation in the intellectual powers of the Vertebrata, with one rather wide gap (not half so wide as in many cases of corporeal structure) between say a Hottentot and an ourang, even if civilized as much mentally as the dog has been from the wolf. I suppose that you do not doubt that the intellectual powers are as important for the welfare of each being as corporeal structure; if so, I can see no difficulty in the most intellectual individuals of a species being continually selected, and the intellect of the new species thus improved, aided probably by effects of inherited mental exercise. I look at this process as now going on with the races of man; *the less intellectual races being exterminated.* If I understand you, the turning point in our difference must be, that you think it impossible that the intellectual powers of a species should be much improved by the continued natural selection of the most intellectual individuals. To show how minds graduate, just reflect how impossible every one has yet found it, to define the difference in mind of man and the lower animals; the latter seem to have the very same attributes in a much lower stage of perfection than the lowest savage. I would give absolutely nothing for the theory of natural selection, if it requires miraculous additions at any one stage of descent."¹

"Your criticism of the rasping noise made by insects being necessarily rhythmical is very good; but though not made intentionally, it may be pleasing to the females from the nerve cells being nearly similar in function throughout the animal kingdom."²

The quotations I have given seem to me sufficient to exhibit and explain the Darwinian Idea of Mental Development. Simply stated, mental development for all the organic species, means a *progressive series of mutual interdependencies*. This idea was the outcome of Darwin's concepts of mind and its changes, and of its relation to brain. Neither mind nor brain evolves alone, hence, neither conditions the other more than it is itself conditioned; but together they make a continuing process, ever more differentiated, more complex; a process, which, taken in its entirety, we recognize and describe as Mental Development, both for the individual and for the race.

SUMMARY.

We have seen (1) that Darwin believed that mind is causally related to organic evolution; (2) that by mind he meant the specific manifestations of a living organism and its reactions upon its environment as distinguished from the merely mechanical reactions; (3) that he held the relation of mind and body to be one of interaction and interdependence; and (4) that Mental Development is a progressive differentiation, accompanied by, and causally interrelated with the development of the body. How, then, shall we sum up his position,

¹ Letter to Lyell, in *Life and Letters*, Vol. II, p. 7. Italics mine.

² *Life and Letters*, Vol. II, p. 364.

and where, in the history of thought, do his philosophical affinities place him?

There can be little doubt from the foregoing that Darwin held the views taught in the popular psychology of his day, which adhered strictly to Cartesian dualism in its explanation of the relation of mind and body. This psychology held "that the substances of the world are divided into minds and bodies; that minds are not in space, while bodies are extended; that minds obey the laws of thought, and bodies the laws of mechanics; that minds are free, and bodies subject to a blind causality; and that, nevertheless, these different forms of existence are occasionally connected with one another, and can influence each other."¹ All this is a matter of course to the great majority of unphilosophical, educated men.

Cartesianism is a statement of what may be called the static relationship of mind and body: it endeavors to account for a particular mind and a particular body at a particular time. Upon this foundation Darwin now builds a new structure. One group of phenomena had early assumed an immense importance to him,—the phenomena of *inheritance*. The thought of hereditary transmission, perhaps always foremost in his biological studies, had deeply imbued him with the idea of life as expressed in an organic series, as well as in a single form. He saw that living beings were not only maintaining their individual interactions of brain and mind, but that these interactions were changing and progressing,—progressing in a definite direction, moving onward, under the laws of inheritance, from the lower to the higher, from the simpler to the more complex. To the facts of the given moment he added the facts of a period of time; to the laws governing the individual, the laws governing the species; and to the concept of the mere existence of a living being, the concept of the development of that being, and the evolution of the series of which it forms, by inheritance, a causally related link. Darwin's philosophical position may thus be summed up in three words, as *Cartesianism plus Evolution*.

APPENDIX.

It may not be without interest, as bearing upon Darwin's views of mental development, to note the psychological literature with which he was evidently familiar and which he quoted, and also some of the important works of the time which he seems not to have known. I select the following titles from the foot-notes of the "Origin of Species," "Descent of Man" and "The Expression of the Emotions in Man and Animals," and include in it a few works which are not strictly psychological, but which seem in place here.

¹ W. Wundt: *Essays*, p. 130.

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It is to be noticed that Darwin quoted from books published as late as 1873, the year of the publication of his last philosophical work, "The Expression of the Emotions." To the following (though very incomplete) list of important works I have failed to find reference throughout his writings, or in his "Life and Letters." These, with the exception of the "Life and Letters," were all published previously to the above date. This omission, from a man so scrupulous in giving his authorities, would appear to mean, either that he did not keep up with the current psychological and philosophical literature, or that, knowing these works, he never found occasion to mention them. The latter assumption, in view of the large use he made of the researches and writings of others in supporting his own views, seems absurd; and we are justified in assuming that Darwin was not familiar with them.

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THE INFLUENCE OF FORCED RESPIRATION ON PSYCHICAL AND PHYSICAL ACTIVITY.

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The effect of various psychical and physical activities upon respiration has been investigated by psychologists and physiologists, and intimate relations have been established. These relations, however, have been studied but rarely from the reverse standpoint, though there is good ground for deeming such a study profitable.¹ The following study is an attempt to investigate one of these reverse relations, that, namely, which exists between voluntarily increased rapidity of breathing and various types of physical and psychical activity.

INTRODUCTORY.

A review of the physiology of respiration shows that forced respiration might influence these activities especially in two ways: by increasing the amount of available oxygen in the blood or tissues, and by influencing the rate of circulation and the composition of the blood.

With regard to the first, it is obvious that since the haemoglobin of the blood is normally nearly saturated with O, no amount of forced breathing can greatly increase the amount of O in the blood and so in the tissues unless there is a concomitant change in the rate of circulation. Yet the amount of C O₂ eliminated might be increased by thorough ventilation with normal circulation, and so a relative oxygenation be accomplished. A practical example of the reverse case occurs in "loss of wind" in running, which is often due, not to lack of air inhaled, but to lack of heart power to drive the oxygen-carrying blood to the tissues. It is further clear that no amount of fast breathing or rapid circulation can wholly atone for a paucity of red corpuscles and haemoglobin.

The effect of forced respiration on circulation may be either direct (impeding or assisting the flow of blood to and from the heart) or indirect, by the reaction of the changes in the compo-

¹ This topic was suggested to the writer by President Hall, who has treated many of the more general aspects of the relation of respiration and the air to mental activity, in his class lectures on Cosmology, and I desire here to acknowledge my indebtedness to him and to the subjects who have spared time for my tests.

sition of the blood upon the nervous centers presiding over this function.

The principle that inspiration increases the flow of blood from the brain, while expiration hinders it to such an extent that the brain is raised with each expiration, may perhaps account for a peculiar feeling in the top of the head observed by several of the subjects of our experiments during the forced breathing, and described as an odd mixture of pressure and vacuity.

The general relation of the activity of the nervous centers for circulation and respiration to the proportion of CO_2 in the blood is too well known to need illustration, but the conditions in apnea (momentary cessation of respiration) are not altogether clear, and as this appears to be a regular sequel of such forced breathing as we have used, it may be worth a little consideration. There are two main theories, the chemical and the mechanical.

The first is especially supported by the work of Ewald, who claims that after a period of forced breathing, the system and the blood become hyperoxygenated. The medulla is thus quieted by the presence of much O and little CO_2 , and there is a more or less complete cessation of respiratory movements. This is borne out by the fact that the foetus in its prenatal condition is kept from breathing by the presence of blood richly charged with O, and by certain experiments of Ewald who found that venous blood in apnea contained less than the normal amount of O, and by Pfliiger's experiments showing a slowing of the capillary circulation during apnea so that a larger amount of O may be taken up by the tissues.

Those who hold the mechanical theory that apnea is caused by a weariness of respiration (a fatigue, reacting on the medulla by the vagus nerve, which suppresses its activity), argue that it cannot be proved that the blood is hyperoxygenated, and that, further, artificial forced breathing of H by animals causes apnea.

Gad, Knoll and others hold that the cause is chemical, but due not to hyperoxygenation of the blood, but to the presence of much atmospheric air in the alveoli, which are able to arterialize the blood for some time, but at the normal rate.

Reichert, in the "American Text Book of Physiology," in commenting on this mooted question concludes that "in view of the fact that apnea from breathing O is much more marked than from breathing H, it seems evident that apnea may be due to either gaseous or mechanical factors alone or to both, the latter producing a quicker and more lasting effect."

A recent work on respiration, and one which touches some points identical or closely related to those taken up in the pres-

ent study, is that of William Marce, entitled "A Contribution to the History of the Respiration of Man," London, 1897.

Marce is interested in the medical aspects of respiration, and concerned with the effect of mountain climbing, high altitudes, temperature, food, exercise, etc., on respiration, and the effects of forced respiration or volition, towards forced respiration on muscular power. He studied also the after stages in each case, and tested by elaborate apparatus the amounts of air breathed and the proportions of O consumed and CO₂ eliminated in the various tests. He demonstrates the apneic pause after forced breathing and finds also a second short period of increased breathing always following the apnoea. He finds that an excess of CO₂ is eliminated from the blood by the forced breathing and an excess of O of from 4.7 to 36.4 cc. per minute, is absorbed under the same conditions, thus strongly supporting Ewald's theory of apnoea. It is also an important fact that the same rate and depth of respiration, which in forced breathing gives rise to apnoea, when it occurs as a natural concomitant of muscular exercise, excites no fatigue and is followed by no apnea.

Active volition towards some form of exercise, locomotion, lifting, etc., gives on the other hand tracings with after-stages like the forced breathing curves. Marce finds that forced breathing nearly doubles muscular power and explains it by the fact that the increased absorption of O takes place mainly in the cerebral motor centers, a point of great interest if it shall eventually be confirmed. His conclusions as to apnoea are peculiar. Like Ewald, he finds more O absorbed, but unlike him, argues (from his experiments) that apnoea is purely an after effect of volition. Only when there is volition toward muscular contraction does apnoea occur. Under these circumstances, the cause of the increased breathing is a direct action of a motor center (the one that would be concerned in the muscular contraction if one were made) upon the respiratory center. In forced breathing many accessory muscular contractions are made and the overflow to the respiratory center is from the centers involved in them. Now when volition toward muscular contraction is suddenly suspended (or at the end of the forced breathing) the respiratory center is left unsupported, and missing the added stimulus before received, is sluggish in action, and apnoea results.

EXPERIMENTS ON THE EFFECT OF FORCED RESPIRATION ON PHYSICAL AND MENTAL PROCESSES.

The writer's experiments were carried out upon six subjects, all university students (five Americans and one a Japanese), between March 2nd and June 14th of the current year. They

have been for the most part somewhat rough in character, intended rather to blaze a path in a new direction and to find general bearings than to make exact determinations of particular points.

The tests of physical and mental conditions used were :

1. Dynamometer grip continued through 30 seconds.
2. Adding of digits.
3. Dealing of sixty cards into two piles.
4. Simple reaction time to sound.
5. Discrimination and choice tested by the sorting of sixty cards according to color, red and black.
6. Memory span.
7. Precision of rapid touches.
8. Threshold in discrimination of gray.

Each subject on each day went through the same series of tests both in normal condition and after two minutes of forced breathing. In the latter case each test was made if possible entirely within a single minute directly following the breathing.¹ If the test occupied a longer time, additional breathing periods were inserted. The tests were made on eight days for each subject, exclusive of the preliminary trials which were designed to eliminate most of the practice effects. On four days the normal tests were made first, on alternate days the forced breathing first, thus balancing in the totals any daily effects of warming up, practice or fatigue. Each complete series occupied one hour.

On another day, tracings of the subjects breathing under the various conditions were taken by means of two pneumographs (of the pattern devised by Dr. Fitz, of Harvard,) and a continuous paper kymograph driven by a water motor. Each tracing shows the chest and abdominal breathing and a time curve with 2 sec. intervals.

These tracings reveal a more or less complete apnoeic pause (an extreme case lasting over two minutes) after the forced respiration. Differences in rate, depth and character of the movements in the forced period, and considerable individual differences in the types of normal breathing are also brought out, *e. g.*, variations in the rate of the forced breathing among the subjects are from 19 to 36 per minute; variations in the form are also marked, some subjects increasing the chest movement, some the abdominal; for some, pure apnoea is replaced by very slow, slight respirations with long expiratory pauses; some

¹ In comparing the results of these experiments with those of Marctet it should be remembered that his tests of strength, etc., were made after normal automatic respiration had been established, while these were made as soon as possible after the cessation of the forced breathing.

normal curves show predominance of diaphragmatic, some of costal breathing.

The subjective effects of the forced breathing were in general: more or less dizziness, blackness before the eyes, tingling or prickling sensations in the hands and feet, and a feeling of confusion coupled with energy. Not all these were experienced at once, and all passed away with the cessation of forced respiration. There was often a secondary effect of exhilaration.

Before the special tests, the lung capacity was each day tested with a spirometer. The highest and lowest amount registered by the spirometer and also the average for each subject will be found in Table I, together with his height and weight.

TABLE I.

SUBJECT.	HEIGHT.		WEIGHT.		SPIROMETER.		
	Cm.		Lbs.	Oz.	Miu. Cu. in.	Max. Cu. in.	Av. Cu. in.
J	172.3		137	6.5	190	220	207
Y	156.3		113	8.0	162	180	175
G	176.9		159	14.0	230	259	244
H	171.6		143	8.0	227	255	240
P	170.3		167	10.5	200	240	221
S	168.1		159	2.5	237	257	247
Average	169.2		146	1.6	208	235	222

The first of the regular daily tests was that with the *Dynamometer*. The apparatus was essentially that used by Bryan,¹ but only one hand was tested, and an attachment was made by which a reduced tracing of the fatigue nerve could be obtained. The subject maintained a maximum pressure for 30 seconds, the height of the mercury column being also recorded by the experimenter at the beginning and end of this period, and the form of the fatigue curve being registered on a kymograph drum. The results of these tests show a more or less decided gain both in initial strength and in endurance after the forced breathing. The average numerical readings in centimeters are given in the following Table.

One subject (Y) was unable to hold the mercury for the full period of 30 seconds. His curves showed a peculiar, sudden drop at about the 15th or 20th second. This was occasionally the case with subject H.² In further tests on subject Y at the close of the regular work, he was found able to sustain the mercury for the full period of 30 seconds after forced breathing, but was

¹ This JOURNAL, V, 196.

² Something of the same kind was observed by Lombard in his study of ergograph curves. This JOURNAL, III, 24.

TABLE II.¹
Dynamometer.

SUBJ.	NORMAL.				FORCED.			
	Beginning.	M. V.	End.	M. V.	Beginning.	M. V.	End.	M. V.
J	74.3	4.0	60.6	3.3	73.1	6.9	60.5	4.2
Y	[71.5]	[7.5]			[73.6]	[6.0]		
G	91.4	5.4	68.4	3.0	94.0	4.9	73.3	3.7
H	75.7	3.9	55.5	4.5	79.0	5.0	58.5	4.5
P	82.5	4.3	53.6	6.9	90.5	2.6	58.8	2.3
S	84.1	9.0	58.0	9.5	85.5	8.0	56.3	10.9
Av.	81.6	5.3	59.2	5.4	84.4	5.5	61.5	5.1

still unable to do so in the normal condition. This affords an interesting support to the general conclusions attained. The figures for H are for four days only.

The curves given by this apparatus show great variety from subject to subject, but those of any single subject are extremely uniform in character as has been found by others in similar studies.

The effects of practice, warming up, and fatigue were excluded from the final results as before explained. Averages of the results according to the order specially made to discover such effects show that in the dynamometer test these factors hardly enter at all, or balance each other in amount.

Adding. The next test, taking them up in the order given to the subjects, was adding. Eight columns of 17 numbers each were added each day, the time being taken with a stopwatch and the correctness of the results being noted. The columns all footed up between 131 and 142, and were of approximately equal difficulty. The results show no certain difference between the times required for adding after normal and after forced breathing; two subjects add slightly faster, and four slightly slower after the breathing, while the net result is .12 seconds faster for the breathing. The breathing also did not affect the correctness of the work. Interesting individual differences are found, and a strong practice curve shown.

Rapidity of Movement, Card Dealing. The next test was designed to measure the rapidity of movement, and consisted of dealing a pack of 60 specially prepared cards into two piles. Such card tests are of little use to people who lack sufficient manual dexterity to deal them one at a time. This was the case with one at least of the subjects, and in all cases there was a strongly marked practice curve.

¹ M. V. in this and subsequent tables represents the mean variation of the eight daily records from their average.

The dealing test also gave negative results, being faster under forced breathing for three subjects and slower for two, with total averages equal. The sixth subject was so irregular in dealing that a substitute test was provided, consisting simply of making small crosses with a pencil at maximum speed for 30 seconds. This was not a very satisfactory test, but showed, so far as it showed anything, the same negative results as the other.

Simple Reaction Time. The fourth test was the simple reaction to sound. At first this was taken by means of an electric tuning fork, vibrating 100 times per second, writing through a small electro-magnetic signal on a smoked drum. For this method was later substituted the more accurate Hipp Chronoscope with a falling-ball stimulus. With the first apparatus from 30 to 40 reactions were made each day, with the Hipp 20.

The results show that five subjects average longer in reacting after the breathing, the sixth takes only 0.0004 longer in the normal condition, a difference so small as to be negligible. The average is 4.25 σ longer after forced breathing. The number of daily tests in which forced breathing lengthens the time is also greater than half, so that it is probably safe to say that forced respiration has some slight tendency to lengthen the simple reaction time.

The averages for reactions are here given :

TABLE III.¹*Reactions.*

SUBJECT.	NORMAL.		FORCED.		F-N.
	σ	σ	σ	σ	
J	145.0	7.9	147.0	13.2	2.0
Y	134.0	9.0	139.6	6.6	5.6
G	141.8	6.6	144.9	6.5	3.1
H	143.7	10.6	148.9	10.5	5.2
P	132.0	6.7	131.6	4.9	-0.4
S	141.6	4.0	151.6	4.5	10.0
Average	139.7	7.5	143.9	7.7	4.25

Discrimination Test, Sorting Cards by Colors. The second form

¹ Owing to a loss of some records, the mean variations in the *individual* reaction times of all the subjects cannot be given. Incomplete records for four subjects show an average of the mean variation in the reactions in normal condition of 13 σ, under forced breathing of 16 σ. The slightly greater variation in the latter case may be due to the fact that when using the Hipp Chronoscope, the subject was made to do forced breathing before each reaction. This, in itself, may have lessened the constancy of attention.

of card test is next in order. It consisted in sorting from four to six times the well shuffled pack of 60 cards into two piles, this time according to color—black and red—as a rough index of the discrimination time plus the above mentioned dealing time. Subjects were required to make a quick motion of correction in case a card was wrongly placed. The time was taken by stop-watch. The general remarks about the dealing test apply also here though to a less degree.

The results (v. Table IV) show on the average a slightly lower sorting time after forced breathing. This longer time, since the dealing test gave negative results, may be attributable to the more purely mental process of discrimination, but may be due, as suggested by the tests in discriminating grays, to poorer perception of the colors. Four of the five subjects show this tendency; the fifth leans very slightly the other way, while in the case of a sixth, the cards were again of no avail and a special discrimination test had to be arranged—reactions with right or left hand to two slightly different sounds. The results of the sorting test are given below in seconds.

TABLE IV.
Sorting 60 cards.

SUBJECT.	NORMAL.	M. V.	FORCED.	M. V.	F-N.
J	53.06	2.05	54.45	1.44	1.39
Y	45.06	2.33	45.61	1.52	.55
G	50.04	1.39	49.64	0.62	.40
H					
P	41.27	1.62	42.41	2.32	1.14
S	45.34	2.33	45.79	1.83	.45
Average	46.95	1.94	47.54	1.54	0.706

The discrimination tests on subject H with the chronoscope, confirmed the general result from the card sorting. The average normal time was $340 \pm 2\sigma$ with an average mean daily variation of 41σ ; the average after forced breathing was $356 \pm 7\sigma$ with an average mean daily variation of 45σ .

Test No. 6 was a test of *memory*. At first series of ten printed nonsense syllables were exposed for the subject's study during a period of 30 seconds. This method was found poor, however, in practical working, since the subjects changed their method of learning; now visualizing, now committing by articulating, now by sound, and now by association; and the results were not at all uniform. A method free from most of these defects was found in testing the memory span with numerals read by the experimenter in time with a pendulum swinging once in .74 sec. This insured uniform speed. Nine numerals

were commonly used, but ten were necessary for subjects P and S after a day or so of practice. The results were obtained by recording the number of errors made by the subject, in writing the numbers immediately after dictation. Errors in position as well as in the digits themselves were counted. Unfortunately no record of the number of transpositions (the most frequent error) was kept.

With the exception of one subject (Y, a Japanese), the results uniformly show more errors after the breathing and the final average points in that direction. The one exception may be due to a fact revealed towards the end of the experiment that the memorizing was sometimes done in English, sometimes after translation into Japanese. I have therefore omitted his results in the average.

TABLE V.
Memory.

SUBJECT.	NORMAL.	M. V.	FORCED.	M. V.
J	18.50	3.12	19.70	2.57
Y	[25.00]	[4.25]	[22.60]	[2.22]
G	4.87	1.59	6.62	3.62
H	5.50	2.40	7.46	3.04
P	2.13	1.87	4.50	2.50
S	2.37	1.62	3.37	2.00
Average	5.56	2.12	6.94	2.74

The test for *precision* of aim caused considerable trouble before a suitable one was found. The form of test finally used seems to combine all the necessary points, viz.: the same frequency and speed in the thrusting movement, impossibility of correction by practice, an easy evaluation of the results, and the securing of a large number of tests without too great waste of time. It consists in having the subject try to touch, with a lead pencil, moving it in time with the beat of a .74 sec. pendulum, a series of ten small crosses irregularly placed on a sheet of paper, the pencil being raised each time to the height of the shoulder. This process was repeated, making a total of 20 thrusts after each form of breathing. The error is given in the table in millimeters.

The results from this test show that while, as would be expected, the error of each single thrust is quite variable, the average errors of a series of 20 thrusts are an almost constant quantity for each subject after the first practice effect has passed. The results also show a clear and regular increase in the errors after forced breathing.

Table VI shows the general averages for each subject, and the

averages of the daily mean variations. The probable errors of the general averages, though not given in the table, are very small, and justify the conclusion that forced breathing increases the error.

TABLE VI.
Precision.

SUBJECT.	GENERAL AVERAGE.				AVERAGE OF DAILY M. V.	
	Normal Breathing. Mm.	M. V. Mm.	Forced Breathing. Mm.	M. V. Mm.	Normal Breathing. Mm.	Forced Breathing. Mm.
J	4.05	0.39	4.88	0.43	1.80	1.89
V	3.93	0.46	4.51	0.47	1.62	2.18
G	5.30	1.09	5.51	0.66	2.82	1.95
H	6.18	0.69	6.61	0.89	2.65	2.65
P	5.02	0.67	5.99	1.01	2.64	2.74
S	4.54	0.24	4.95	0.24	2.35	2.44
Average	4.84	0.59	5.41	0.61	2.31	2.31

The order had considerable influence in this test, five out of six subjects being more accurate in the second half hour irrespective of whether the forced breathing tests came first or those with normal breathing.

Discrimination of Grays. The final test was intended to be more purely sensory than those which have been given. It was visual, and consisted in a determination of the just observable difference of grays. The apparatus was a modification of that used by Leuba, and described in this JOURNAL, V, 376. A rapidly revolving vertical pasteboard disk 368 mm. in diameter and pierced with 12 radial slits each, 138 x 13 mm. was interposed between the subject and the grays to be discriminated. The disk was covered with white (later light gray) paper, and arranged to slide vertically for a distance of 120 mm. The subject being seated before a tube 61 cm. long in front of the disk, looked through the tube and the disk at figures of various forms (square, triangle, hexagon, letter H, etc.), which were made of quite dark gray paper approximately 70 mm. square, and pasted in the center of a background of a very little darker gray paper 153 mm. square. These diagrams were 270 cm. beyond the disk. When the disk was low down in its slide, so that the subject looked through the upper part of it, the grays of the figure and background could not be distinguished, and the form of the figure could not be told. In making a determination, then, the disk was raised till the figure could be discriminated from its ground and correctly named, when the elevation of the disk in millimeters was recorded. The conditions of the tests allow the results only a

relative value because of variations in illumination. Constant lighting could not be secured in the present case, and often tests were thrown out on account of variations in the outdoor light during the eight or ten minutes used in the test. The results, however, are sufficient for a comparison of the effects of forced and normal breathing. In making the test, each subject on each day was given five diagrams in the first test, and the same five in the second, though altered in order and in their position in the holder. The results from this test were very striking.

The average for every subject, not only in the totals, but for every day's tests, shows that the diagrams appear later, more confused, and are distinguished with more difficulty after the forced breathing.

In these tests the subjects had curious illusions and apperceptive experiences, *e. g.*, two upright parallel lines were often declared with certainty to be the "H." These phenomena increased with the forced breathing, which was uniformly said to make the figures hazy and flickering, even to such an extent that after the given figure was recognized, it seemed to some subjects to slide and alter its position on the background. Others found that in forced breathing, the whole diagram suddenly shifted in color, being alternately black or gray, or again a gray would appear in the center and gradually spread out to the borders.

The *tests of the effects of forced breathing upon circulation* have been of a tentative nature and few in number. The pulse rate of the various subjects before, during and after the forced breathing was once counted, and showed a slight quickening during the second minute of breathing; but by two minutes of the cessation of the forced respiration, the pulse had usually fallen again to the normal rate. A couple of tests of the eye pulse were made with the plethysmograph,¹ but with negative results.

If we now sum up the general results of this study we find the effects of forced breathing to be

1. An apnœic pause, as observed by Marcket.
2. A feeling of dizziness and confusion, followed somewhat later at times by exhilaration and clearness.
3. Greater strength and endurance of grip, found also by Marcket, but after an interval in which breathing returned to the normal condition.
4. Slightly lengthened reaction time.
5. Decreased memory span.
6. Longer discrimination time.

¹ *Psychological Review*, IV, 120.

7. Less precision of movement.
8. Poorer visual discrimination.

The simple throwing of cards in two piles and adding are apparently uninfluenced. Whether with more extended experiments this would be the case cannot now be asserted, but, these apart, the results seem to point to an improvement of the muscular mechanism, as the expense of the mechanisms of control and of the higher functions generally.

It would be interesting to follow the subject into the fields of early philosophy, where, as every one knows, breathing and soul have often been practically synonymous, and into the modern oriental cults where proper breathing is regarded as the road to insight and inspiration, and into the hygienic developments of respiratory gymnastics in the modern "deep breathing" schools, and among the "Ralstonians," but these are all quite beyond the scope of the present paper, which is confined to the report of experimental pioneering.

A METHOD OF RECORDING EYE-MOVEMENTS.

By E. B. DELABARRE, Professor of Psychology, Brown University.

Many problems suggest themselves to the psychologist whose solution would be greatly furthered by an accurate method of recording the movements of the eye. One such problem in particular has aroused my interest, namely, the relation of eye-movements and eye-strain to our spatial judgments, and the bearing of this relation on the explanation of various geometrical optical illusions. While I cannot claim to have completely solved the problem of obtaining an accurate record of the movements made by the eye under such circumstances, I nevertheless have succeeded in reproducing them with a certain degree of accuracy ; and by publishing my method in spite of its crudeness in certain respects, I hope to be of service to others who may be engaged on similar problems, and to receive suggestions for its further perfection.

After considering and testing numerous possibilities, I was forced to the conclusion that only by firmly attaching some solid object to the surface of the eye or to the eye-muscles, as a support to a mirror or to a thread for moving levers, could my object be obtained. I am indebted to Dr. Lough, my assistant last year in the laboratory at Harvard, for the suggestion that plaster-of-Paris will attach itself firmly and immovably to any moist surface. Acting on this suggestion, I made a few plaster casts over the cornea of an artificial eye. I thus produced a smooth concave surface that would fit fairly well the curvature of the cornea of a natural eye. This I trimmed with a knife to the diameter of the cornea, and to a thickness that would make it as light as possible while retaining the requisite firmness. Then I made the eyeball anæsthetic by applying two or three drops of a two to three per cent. solution of cocaine, and on fitting the cast over the cornea found that it held there perfectly, without pain or discomfort.

The problem of obtaining a firm support was thus solved. How to use it for obtaining a record of the eye-movements was yet a question. My first attempt was to fasten to the outer surface of the plaster cast a small concave mirror of known focus, and to reflect from it a strong ray of light onto a photographic plate. This reflected ray reproduced accurately and magnified all the movements of the eye. I found difficulty, however, in

obtaining a record of its path on the sensitive plate, and was compelled to abandon the attempt. This difficulty arose partially from the rapidity with which the spot of light moved across the plate, but partly also no doubt from my own unfamiliarity with the dispositions of apparatus necessary for obtaining a sharply defined image of the light-streak under such conditions. It seems to me probable that this photographic method is feasible, and I hope that this account may come to the notice of some one who can give me directions for making it successful.

I finally adopted the method of casting within the plaster a thin wire ring, from one side of whose circumference a branch projected to the outside. It was then possible to make a hole through the center of the cast, of about the size of the pupil. The wire ring surrounded this hole, imbedded within the plaster, and to its projection, situated just to one side of the opening, it was easy to attach a light thread leading to a recording lever. On the side of the lever opposite to the attachment of the thread I fastened a thin elastic fibre, and thus the lever moved back and forth in correspondence with the horizontal movements of the eye, and recorded them on the smoked surface of a kymograph cylinder. By running the thread over a pulley, it was similarly possible to record the vertical movements. Slow movements could thus be recorded with great accuracy. But in the case of the more natural rapid movements, the tendency of the lever and elastic fibre to continue vibratory movements of their own after those of the eye had ceased led to some results difficult to interpret. The periodicity of these vibrations gave me sometimes a valuable method of determining the time-relations of the eye-movements under various conditions, but prevented an absolutely accurate determination of the exact form of the movements. The method therefore still remains crude. I have, however, by its use satisfied myself that spatial judgments are closely dependent on eye-movements and eye-positions, and that many geometrical optical illusions can be proved to owe their explanation to this fact. I have also discovered, I think, a new factor of influence in these illusions,—namely, the fact that the actual point of fixation of the eye is not always the one intended and thought to be fixated. If, for instance, when the endeavor is made to fixate the point of an arrow-head, the actual point of fixation falls within the angle, as my results seem to establish, then in the Müller-Lyer illusion the length of eye-movement is actually less in the case of the diagram that appears shorter. A fuller account of the results that lead me to these conclusions I must however reserve until an improvement in the method and further opportunity for research permit of their verification.

A few further details will be of value to those who may wish

to adopt and perfect this method. The eye should first be cocaineized as above indicated. Then the lids should be propped apart by some form of eye-lid fastener, of which the best is probably that in form of a wide-opening spring with tortoise-shell grooves for the lids. The plaster cast may then be applied, with its opening directly over the pupil, and it will at once adhere firmly. If the amount of cocaine used has not been sufficient to interfere with accommodation, it will then be possible to see with the harnessed eye almost if not quite as well as with the other. The plaster will not detach itself until it becomes thoroughly soaked with tears. I have taken records for over an hour without inconvenience from its application or from the propping open of the lids. If it is desired to obtain release before it detaches itself, it cannot be pulled off without injury to the eye, but a few drops of water applied within its opening and to the eye around it will cause it to float off at once.

As to whether there is any danger to the eye to be feared from using it in this manner, I cannot say with assurance. I have myself always suffered a little temporary inconvenience due to the strain on the eye-muscles, to the affecting of the accommodation by the cocaine, and to the fact that a cast over an artificial eye never corresponds exactly to the curvature of one's own cornea, and the latter probably alters itself during the experiment to fit the cast. I have also found it necessary to allow a considerable interval to elapse between experiments, — usually a week. The unpleasant effects have always soon passed, and now, a full year since my last experiments, I can detect no ill effect.

PRELIMINARY EXPERIMENTS IN THE PHYSIOLOGY AND PSYCHOLOGY OF READING.

By EDMUND B. HUEY, Fellow in Psychology, Clark University.

The present article is a report of experiments preliminary to a study of the Psychology of Reading, the general purpose of the study being to learn as far as may be just what occurs physiologically and psychically, in reading a printed page.

A series of experiments was first undertaken to decide the comparative merits of printing in columns of the ordinary width and in very narrow columns, with the belief that the speed-tests, etc., taken in this side problem, would be valuable and, especially, suggestive for the larger study yet to be made.

I. COMPARISON OF SPEED IN VERTICAL AND IN HORIZONTAL READING.

It would seem that in reading matter printed in sufficiently narrow columns the eye's lateral movement might be eliminated or nearly so, and the reading be done with one downward sweep of the eye. Among the advantages to be expected from such reading might be mentioned (1) the very great decrease in the work of the oculo-motor muscles; (2) the elimination of the asymmetrical change in accommodation, which Javal (*Rev. Scientifique*, 1879,) mentions as one of the main causes of fatigue in reading ordinary lines; (3) whatever advantage may be incident to having within the range of clear vision as much as possible of immediately related matter; (4) facilitation of the process of skimming.

I have confined myself to a comparison of speed, and have made the narrow columns contain but one word to the line, *i. e.*, having the center of each word just over the center of the next succeeding word.

Experiment A. There were printed on a Remington typewriter 15 lists of 50 words each in nonsense-arrangement, even similarity of first and last parts of words being avoided, and no two alike, in vertical column; and each list was also printed in ordinary horizontal fashion, but in reverse order of words, the lines being made a little shorter than the length of the columns, the type and other conditions similar in horizontal and in vertical lists. The first list contained only words of two letters; the second, words of three letters, etc., to and including a

list of 16-letter words. A list of 50 letters of the alphabet, in nonsense-arrangement, was added, with its reversed form as with the word-lists.

As the typewriter gave the same space to each letter regardless of the letter's form, all the words of a list were of equal length and both margins were straight.

The lists were read aloud by the subjects as fast as possible. The time was taken with a stop-watch marking fifths of second nominally, though tenths could be read from it. The readings were made as follows: The list of two-letter words would be read, *e.g.*, first in the horizontal arrangement, then in vertical; then in vertical again, then in horizontal; then horizontal of the 3-letter list would be read, and a similar order would follow. Care was taken to arrange the order of tests so as to eliminate the errors due to practice, etc.

There were thus two comparisons (two horizontal readings and two vertical readings) for each of the 16 lists. The four subjects tested are members of this University as are the subjects serving in other tests presently to be mentioned.

The results may be found in Table I.

It is interesting to observe that while the shorter words are read more rapidly in horizontal sequence, the longer are read more rapidly in vertical. Though the mean variations are large, the relation is so frequently repeated that it seems not wholly accidental.

Experiment B. 1. In this test the subjects read aloud as fast as possible a sense passage of 300 words, divided into 6 parts of 50 words each. The whole passage was printed in both horizontal and vertical arrangement. The lines of the horizontal arrangement were about two-thirds the length of the vertically printed columns.

Owing to the great difficulty of printing or type-writing words with centers in a vertical line, as half spaces would be needed for words of an odd number of letters, the arranging in vertical columns was done by hand, the words being cut from an exact duplicate of the horizontal copy used in the experiment and pasted on a background of white paper, the columns being placed as close to each other as the length of the longest words would allow. One reading of the passage was then taken, fifty words at a time, the first fifty being read vertically, second 50 horizontally, third vertically, and so throughout. Some days later, a second reading was taken, the parts read in vertical arrangement at the first reading being now read horizontally, and *vice versa*.

TABLE I.

Showing average times for reading aloud at maximal speed the same (nonsense) material in vertical and horizontal arrangements.

No. Letters		W.		C.		P.		H.		Av. 4 Subjects.	
		T.	M. V.	T.	M. V.	T.	M. V.	T.	M. V.	T.	M. V.
1	V	17.1	.3	16.5	.6	15.9	1.3	13.4	.8	15.7	.75
	H	15.8	.5	13.9	1.0	14.5	.5	12.2	.2	14.1	.55
2	V	18.1	.5	18.2	2.6	16.8	.8	15.8	.2	17.2	1.00
	H	15.8	1.0	17.5	1.8	17.3	1.3	12.0	.8	15.7	1.20
3	V	18.1	.8	17.3	1.8	15.5	1.1	15.3	.1	16.6	.95
	H	15.1	1.4	17.2	1.2	16.4	1.6	11.4	1.4	15.0	1.40
4	V	19.0	1.1	19.3	1.3	15.4	.6	15.3	1.3	17.3	1.08
	H	16.1	.3	19.9	.7	16.4	1.6	12.0	.8	16.1	.85
5	V	18.3	.8	18.7	2.1	14.1	.1	15.6	.6	16.7	.90
	H	17.0	.6	20.3	.3	15.9	1.1	14.1	.3	16.8	.58
6	V	17.6	1.7	23.4	3.4	16.3	.5	16.2	.4	18.4	1.50
	H	16.4	1.7	22.0	2.8	19.7	2.5	14.6	.8	18.2	1.95
7	V	17.7	1.4	20.8	1.8	17.1	.3	15.8	.4	17.9	.98
	H	15.2	.4	22.0	.2	16.1	.3	14.5	.7	17.0	.40
8	V	19.5	.7	21.2	.8	20.0	.8	17.8	.0	19.6	.58
	H	18.2	.7	25.3	3.5	20.1	.9	15.9	.3	19.9	1.35
9	V	21.1	.3	23.6	1.0	23.0	2.6	18.9	.3	21.7	1.05
	H	20.3	.2	25.2	4.2	20.8	1.0	18.0	.4	21.1	1.45
10	V	22.9	.8	25.5	.3	23.2	1.2	21.1	1.1	23.2	.85
	H	22.6	.6	27.0	3.6	22.7	1.5	19.7	.3	23.0	1.50
11	V	24.7	1.2	32.7	2.5	25.8	1.0	23.3	.7	26.6	1.35
	H	24.5	1.1	30.0	2.8	28.3	2.7	21.7	.3	26.1	1.73
12	V	28.5	3.3	33.1	.3	28.2	.6	24.3	.1	28.5	1.08
	H	25.9	.9	34.8	3.7	29.7	2.2	24.5	.9	28.7	1.93
13	V	28.9	1.0	35.2	.6	27.9	.3	26.0	.0	29.5	.48
	H	26.2	.5	39.3	7.1	30.6	.2	27.2	.6	30.8	2.10
14	V	31.9	.8	35.9	.3	34.3	1.5	32.9	.1	33.8	.70
	H	32.2	2.5	40.7	6.3	36.5	1.5	32.0	.8	35.4	2.78
15	V	37.0	1.6	55.8	4.2	40.8	2.0	38.5	1.0	43.0	2.20
	H	35.8	1.8	60.5	8.5	48.0	7.5	35.3	3.7	44.9	5.40
16	V	42.5	3.8	68.0	1.6	53.0	3.0	53.0	3.0	54.1	2.85
	H	44.5	1.7	69.3	5.1	59.7	7.5	59.7	7.5	58.3	5.45
Av. V.		23.9	1.26	29.1	1.56	24.2	1.11	22.7	.63	25.0	1.14
Av. H.		22.6	.99	30.3	3.30	25.8	2.12	21.55	1.20	25.1	1.91

The results for three subjects are as follows:

TABLE II.

Showing average time for reading sense passages in vertical and horizontal arrangement.

VERTICAL.			HORIZONTAL.		
Av. time per 50.	Words per sec.		Av. time per 50.	Words per sec.	
T.	M.	V.	T.	M.	V.
P. 10.47	1.1		4.78	10.55	1.2
K. 14.40	.5		3.47	12.00	1.5
B. 14.13	1.9		3.54	12.00	2.0
Av. 13.00	1.2		3.93	11.52	1.6
					4.36

Experiment B, 2. The same test was also made in a somewhat different form. This time the subjects read a sense passage of 323 words, aloud, as fast as possible, continuously, by one method (vertical or horizontal) and immediately read the same passage by the other method. The arrangement in vertical columns was as in the preceding experiment. After some days the reading was repeated, the order being reversed. Results for four subjects follow in Table III.

TABLE III.

Showing maximal speed of reading a sense passage aloud.

VERTICAL.			HORIZONTAL.		
Av. time for 323.	Words per sec.		Av. Time for 323.	Words per sec.	
M. V.			M. V.		
P. 75.05	6.0		4.30	75.3	2.2
K. 74.45	2.4		4.34	66.45	5.5
H. 62.10	1.9		5.20	59.1	.5
D. 109.00	11.4		2.97	99.90	5.1
Av. 80.15	5.4		4.20	75.19	3.3
					4.46

Experiment C. This test was an exact duplicate of the preceding one, except that the reading was done silently instead of aloud. The subjects were directed to read it all, but by their own fastest method, and to pronounce the last word as a signal for the time-taker. Below are the results for five subjects:

TABLE IV.

Showing maximal speed of reading sense-passage silently.

VERTICAL.			HORIZONTAL.		
Av. Time for 323.	Words per sec.		Av. time for 323.	Words per sec.	
M. V.			M. V.		
P. 64.60	10.2		5.00	48.55	4.9
J. 121.80	6.2		2.65	83.70	0.1
K. 46.65	1.4		6.92	34.00	1.2
D. 65.15	6.7		4.96	31.40	3.1
B. 69.90	7.9		4.62	43.65	.15
Av. 73.62	6.5		4.83	48.26	1.9
					7.54

In all these tests with words making sense the advantage is with the horizontal reading, but it is well to remember that the vertically arranged matter of all the sense-passages had been pasted on the page word by word ; and in spite of all care the page presented an appearance more or less different from that of a neatly printed one. The distraction of attention incident to this, and to the vertical arrangement in general, would seem to be greater in silent reading, when no sound of the voice was present to help guide the attention and make visual distractions relatively unimportant. The smallness of the gain in speed in silent reading by the vertical method may be due to this, at least in part.

The enormous amount of practice in horizontal reading, which all subjects have had, must of course be taken into account in any such comparison. Subjects say they can easily read straight down with one downward sweep of the eye ; but that they forget and use the old side-to-side method, taking, of course, more time with such short lines.

Then again, it is probable that the subject may have a greatest possible speed by one method and a greatest normal speed, or speed of comfortable and intelligent reading, by quite another.

Miscellaneous Observations. The readings furnished data of considerable interest aside from the immediate purposes of this comparison.

Rate for words of different length, for instance, in Table I disyllables (6 letter-list) take but little more time than monosyllables (4-letter list) in reading aloud ($18.2 : 16.1$). A five-fold increase in length of words (3-letter to 15-letter lists) causes only a three-fold ($15 : 44.9$) increase in time ; this, too, though the long words were much less familiar. Single letters are seen to take almost as much time as short words, as already observed by Cattell.

Effect of Practice. In Table V below is shown the time of first and eighth readings of some of the 50-word nonsense-lists. The first and eighth readings were by the ordinary horizontal method. Between these were four readings in reverse arrangement and only two in the direct, owing to the peculiar conditions of the experiment. It would seem, then, that the practice in word-order was negative, if anything ; and that the increase in speed was due to increasing familiarity with the words themselves.

The test taken on myself, subject "Hu," indicates that there is a point beyond which further familiarity with the words does not very appreciably increase the speed. In arranging the lists and in the experiments I had become very familiar with every word ; and this no doubt accounts for the constancy of speed.

TABLE V.

Time, in seconds, for first and eighth reading of 50 words in nonsense arrangement, at maximal speed, aloud and intelligibly.

	Single letters.		5-letter words.		9-letter words.		13-letter words.		Average.	
	1st R.	8th R.	1st R.	8th R.	1st R.	8th R.	1st R.	8th R.	1st R.	8th R.
P.	15.0	15.6	17.0	14.6	21.8	21.6	30.4	25.2	21.05	19.25
C.	14.8	11.9	20.0	18.4	29.4	20.8	46.4	29.4	27.65	20.12
W.	16.8	12.4	19.0	17.8	21.3	19.8	29.8	26.1	21.73	19.03
H.	12.0	11.6	14.4	15.0	17.6	17.4	27.8	27.0	17.95	17.75
AV.	14.7	12.9	17.6	16.5	22.5	19.9	33.6	26.9	22.10	19.05

Reading of Sense and Nonsense Matter. The speed in reading aloud was found to be closely correlated with the "sense" made, as might have been expected. Sense-passages were read in little more than half the time taken for nonsense-passages having an equal number of letters. There seems to be a *camaraderie*, as Egger calls it, among our words, and even among our phrases and sentences; and pronunciation of an adjective, for example, seems to subexcite association tracts representing substantives; — preferably and more strongly the substantives with which the particular adjective has been most often associated. Of these subexcited substantive tracts, some are still more excited by closer association with the general subject under discussion in the matter read. The right word, then, is ready to leap out at the slightest suggestion from the printed page, if that passage makes sense. If, however, it does *not* make sense; — if a preposition, *e.g.*, follows the adjective, the utterance of the former must suffer a loss of time due to lack of association in the past between adjectives and prepositions — there is no sub-excitation, to speak in physiological terms, of the organs for pronunciation of the preposition. Indeed, there is more than that; there is an interference of associations such as Bergström investigated in his card dealing experiment.¹ So in certain positions the substantive tends to arouse verbs, the preposition its related object, etc.¹

II. COMPARISON OF THE IMPORTANCE FOR WORD RECOGNITION OF THE FIRST AND LAST PARTS OF WORDS.

A passage of sense-reading containing 456 words was printed in ordinary fashion, making a page of 43 lines, with considerable paragraphing. Several copies of this were obtained. From one copy the exact first half of each word was cut out,

¹ See *Am. Journal Psych.*, Vol. V, 356, ff. Art. on Experiments upon Memory.

letters being cut in half when necessary ; and from another copy the latter half was similarly cut out. The arrangement is illustrated below :

iy ures f ch i eme? f is es ot eal o
 su, en ll ou dly, om i re tical point,
 ate he ages ad orms st atly ded? ir
 pose so bine ese ews, tically id wise, ad
 o nd a nited py o ch ibutor.
 he ems low ely gest ding ics. ect ose
 ou re st ested n ad id ay ers.

arfeat o su ε sch I th do nc app t
 yc th wi yc kin fr ε mo pract stand
 sta ti char ar ref mo gree nee Or purp
 i t com the vie statist ar other ar
 t se ε prit co t ea contri
 Tb ite bel mer sugg lead top Sel the
 yc ai mo inter i ar ad an oth

any features of such a scheme ? If this does not appeal to you, then will you kindly, from a more practical standpoint, state the changes and reforms most greatly needed ? Our purpose is to combine these views, statistically and otherwise, and to send a printed copy to each contributor.

The items below merely suggest leading topics. Select those you are most interested in and add any others.

Each page thus honey-combed, was fastened closely upon a white paper background. The page was then marked off into four divisions. Two readings were taken, separated by several days. The subjects read the entire passage at each sitting. At the first reading, *e.g.*, the subject would read the first division of the passage, with the first half removed ; then the second division with the latter half removed, and so alternating. At the second reading he would read the first division with the latter half removed, then the second division with first half removed, and so reversing the order throughout. The passage used had not been read by the subjects previous to the experimental reading. The subjects were directed to read as fast as they could consistently with making as good sense as possible, but not to feel that they "had to hurry." They read aloud, the experimenter following the reading on a duplicate copy, and marking the words read correctly. The time spent on each division was taken with the stop-watch, the subject giving a signal when he reached the end of a division, never returning to correct mistakes. The first division contained 163 words, the second 125, the third 111, the fourth 57. Below are the results for three subjects :

TABLE VI.
Comparative importance for word-recognition of the first and last halves of words.

		FIRST READING.		SECOND READING.		TOTAL BOTH READINGS.									
Subjects.		Part removed.		Words in passage.		Time (in seconds).									
K		1st half ..	638	274	207 75.6	.32	361 182	144 79.1	.40	999	456	351	77.4	.35	
J		2d half ..	427	182	159 87.4	.37	369	274	253 92.3	.68	796	456	412	89.9	.52
V		1st half ..	767	182	62 34.1	.08	836	274	168 61.3	.20	1603	456	230	47.7	.14
		2d half ..	1113	274	189 69.0	.17	555	182	153 84.1	.28	1668	456	342	76.6	.21
Total		1st half ..	423	274	219 79.9	.52	322	182	153 84.1	.48	745	456	372	82.0	.50
		2d half ..	238	182	161 88.5	.68	332	274	253 94.9	.76	570	456	414	91.7	.73
		1st half ..	1828	730	488 66.9*	.31*	1519	638	465 72.9*	.36*	3347	1368	953	69.9*	.33*
		2d half ..	1778	638	509 79.3*	.41*	1256	730	659 90.3*	.57*	3034	1368	1168	85.1*	.49*

Note.—The starred numbers are averages from the vertical columns in which they stand, not recalculations from the totals to the left of each.

Among the factors that co-operate in this result may be mentioned (1) the tendency of English to place the accent on the first part of the word, the accented part tending to represent the word, at least the spoken word; (2) the preponderance of suffixes over prefixes, the main root of the word being in the first part, thus rendering the first part more important.

It seems probable also that the time-order in ordinary inter-association of syllables and other divisions of words has much to do with the difference shown. This time-order has almost always been from the first toward the latter part; and, as has been shown by various experiments, associations do not work nearly so well in reverse time-order.

III. MOVEMENTS OF THE EYE IN READING.

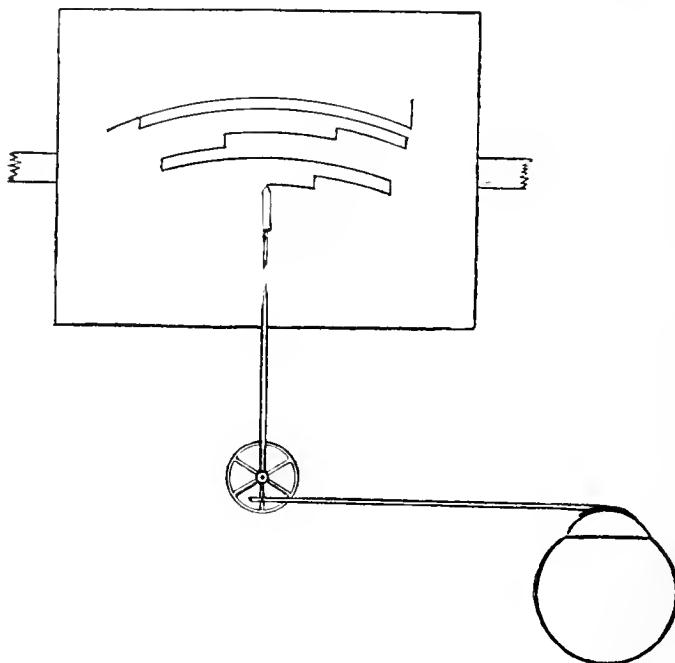
By watching the eyes of subjects while reading matter such as a page of this JOURNAL, I found that I could always tell them, at the end of a passage, just how many lines they had read, despite their subjective notions that their eyes did not sweep along each line. By having the subject read aloud and noting the syllable pronounced just as the eye turned for the return sweep, I found that I could get the approximate distance of the eye ahead of the pronunciation, for at least one point in the line.

Besides, the most casual observation showed that the eye moved along the line by little jerks and not with a continuous steady movement. I tried to record these jerks by direct observation, but finally decided that my simple reaction to sight stimuli was not quick enough to keep up with them when the subject read at normal speed.

It seemed needful to have an accurate record of these movements; and it seemed impossible to get such record without a direct attachment of recording apparatus to the eye-ball. As I could then find no account of this having been done, I arranged apparatus for the purpose and have so far succeeded in taking 18 tracings of the eye's movements in reading as many passages consisting of from 9 to 30 lines each, in different sizes of type and with lines varying in length from 21 mm. to 120 mm.

The apparatus consists essentially of (1) a frame for fixation of the head, fastened between iron standards which are clamped to a heavy table; (2) of a light recording arrangement, resting on the top of one of the standards, connecting by a light celloidin-covered glass lever with a cup capping the cornea, and writing its record on the smoked drum of a kymograph by means of a celloidin-tipped tubular glass pointer, (below is a somewhat simplified horizontal plan of the arrangement for recording); (3) of an electric time-marker wired to a clock

marking quarter-seconds, and writing its record on the drum just opposite the record of eye-movements; (4) of a holder for the reading matter, arranged to slide on a track bearing a scale of distances measured from the front of the cornea.



A permanent fixation of the head with reference to the recording apparatus and reading matter is obtained by having the subject bite into a mass of partially cooled sealing-wax attached to a mouth-piece fastened in the head frame; the imprint of the teeth being preserved when the wax hardens.

The cups used for attachment to the cornea were made by casting plaster-of-Paris over either a carnelian marble or a steel ball having a radius of curvature a very little less than that of the cornea. The outer surface of the cups was sand-papered until quite thin and light and a hole was drilled through the center, of a diameter of 1.7 mm. The cup has been placed on the left eye, in experiments thus far.

As may be seen from the diagram above, there was no weight on the eye but that of the cup and short lever directly attached to it; and the work of the eye-muscles needed to run the recording-apparatus is almost imperceptible in actual reading.

The eyelids are kept separated and the subject prevented from winking by lead fingers fastened to the head frame and pressing sufficiently upon the skin above and below the eye.

The eye was rendered anaesthetic by the use of cocaine. Beyond the dilation of the pupil (corrected by the cup acting as a diaphragm), and an occasional interference with accommodation, the normal action of the eye seemed to be in no way interfered with.

In beginning each test the eye was fixated on the left end of the first printed line, or of two or more parallel ink lines drawn above this. When the kymograph had attained its proper speed, at a signal from the assistant, the eye was moved along the line and fixated on the other end, then back, and so on, back and forth for from two to five lines before the reading began. This was done to furnish known bases for comparison with the later curves. The curves show no interruption from end to end, until the reading begins. Then, however, the curve is not only *always* interrupted by the eye's several fixations, but is always shorter than the curve representing the lines whose ends were fixated, showing that the eye does not travel the entire length of the line in reading.

In some of the tests the ends of the last two lines were fixated also, and probably this will be found most convenient for purposes of measurement. By reading the same matter at different distances from the eye, the number of jerks was shown to be a function of the matter read rather than of the arc described by the eye's rotation.

A series of eight tests was taken with special reference to determining what function the lateral movement of the eye is of the length of the line, and with what width of column the lateral movement may cease and the reading be done with one downward sweep of the eye. The passages used were cut from *Munsey's Magazine* and the *Cosopolitan*, and were in their ordinary size of type, with lengths of line varying between 21 and 120 mm.

The tests show at a glance that the lateral movement decreases much faster than does the length of the lines and that at 21 mm. the reading may be done without lateral movement, though this is still apt to occur, probably from habit.

By the help of the quarter-second record written on the margin of the paper, it is possible to measure approximately the time during which the eye remains fixated at each point, but the unit is too large for getting the speed with which it moves from one fixation point to another.¹ The latter point is espe-

¹ A promising attempt has been made to measure this by means of the spark method of time recording.

cially interesting, as it would seem from the curves that the speed may be so great that the retinal impressions fuse and that we really do not see foveally what we read except at the few points on the ordinary line at which the eye pauses. These experiments are as yet incomplete; and the data which they furnish cannot be arranged in time for this report.

For the suggestion of making a direct attachment to the eyeball, I am indebted to Dr. August Ahrens¹ who reports making a firm attachment of an ivory cup, but failed to record the movements. I am told that cups of glass have also been attached, in ophthalmological practice. I am also indebted to Prof. Delabarre for the suggestion of plaster-of-Paris as a most convenient material, and this has been used thus far, ivory cups being rather troublesome to make, while the plaster-of-Paris is easily workable.

No trouble was experienced in getting the cup to stick for as long as was desired, when the lids were kept well separated; indeed, it was somewhat difficult to remove it on several occasions. The experiments have so far been made on but two subjects — Prof. Hodge and myself. I am especially indebted to Prof. Hodge, as it has been difficult to get subjects; partly from an exaggerated notion of the danger to the eye, partly from the defective vision of those who were otherwise available.

¹See his "Die Bewegung der Augen beim Schreiben," Rostock, 1891.

ON CHOICE.

By CAROLINE MILES HILL.

The person who has not, at some time or another, realized that choice is a problem, is certainly an exception. Most of us must confess that upon some occasion we have retired to our closets and there tossed up a penny to get rid of a troublesome decision. It is a matter of common observation also, that for two classes of persons choice is very difficult and sometimes impossible for those absolutely ignorant of the relations and consequences of either of two courses of action, and for those who know the arguments to both sides of the question and have no prejudices to consult. A child is often more annoyed and disturbed by being urged to decide something for itself than by any amount of compulsion. It is nothing unusual to hear an ignorant and vacillating individual say he does not care which of two alternatives he accepts, nor is it unusual to hear the wise and resolute person say that in view of all the facts to both sides, it is next to impossible to say which group should be chosen. If only "once to every man and nation," came the "moment to decide," choice might not be a psychological problem worthy of investigation, but when it comes daily in some form, often so predetermined that it does not rise into consciousness as choice, again so much influenced by its fringe of relations to other things that it is called a dilemma, it is clearly a mental act subject to natural laws, which may be assumed to be the same for all kinds of choices. Choice comes to the American nation at least once in four years, and every newspaper in the land considers itself capable of setting forth the natural laws which have determined the nation's choice. Self-interest on the one hand as over against the good of the whole nation, or habit or conservatism, or discontent or what not. The individual thinks he understands the reasons for his own decision on any difficult case, but the motives seen by his "candid friends" are often very different from the ones which he assigns to himself.

The ready answer of the cynic to the question, what causes the difficulty in choosing? would undoubtedly be, choice is difficult where the line of self-interest is not clear. The answer of the psychologist is stated in almost the same words. James (*Smaller Psychol.*, p. 170) says that choice follows attention, and attention interest. Dewey, giving the interpretative side, says that we choose that in which we are best able to find ourselves, our experience determining with what we can identify ourselves. The whole difference in the two types of answers is in the content of the term self-interest.

Viewed historically, the question of choice is, what, in Greek times, determined whether a man should be a Stoic or an Epicurean? At the time of the Reformation, what made a man a Lutheran, a Calvinist, or a Zwinglian? Later, what tipped the balance in favor of the Tories or the Whigs, the Puritans or the Dissenters? And so on through all the strifes and factions that have divided mankind. Because the tenets of the one side or the other seemed more rational? Rationality, so-called, involves habit, suggestions from friends, influence of surroundings, as well as so-called argument. In fact there are no absolute and abstract arguments, all are personal and concrete. Separating out

the elements so far as they are known, there remains always at bottom one insoluble factor; temperament determines very largely which belief shall seem more rational to any individual, and temperament is, at bottom, a physiological problem.

Any study of choice, then, must be a study of different elements and of their importance and relations to each other, but before this can be attempted there is need of a physiological base line from which to reckon. If we could find some choices absolutely free from thought associations or from calculation of consequences, the unconscious or physical elements might be discovered. There are some suggestive cases where physical force seems to hold us back from a decision which reason recommends. Often we find that obedience to this instinct was very wise.

The practical and ethical bearings of the general problem give it so great an attractiveness that an attempt was made to treat some aspects of it experimentally. The results, though meagre, have a certain interest in themselves; and as their further development by the writer has become impossible, she ventures to give them as they are, hoping that they may prove, if not an assistance, at least a warning to any who may be tempted in the same direction.

In view of the complexity of the problem of choice and of the necessity of eliminating as many of the conscious factors as possible, a few trial experiments were made. In order to find an approximate answer to the question, what conscious motives will influence a choice between two things differing very slightly?

1. A series of sets of two nonsense syllables of three letters each, in which two letters were different (*e.g.*, rab and vab, hib and gib), was shown to a class of twenty-four young women, who were asked to write down one syllable of each set. When the series was finished they were asked to write any conditions which might have influenced their choices. Result: 12 said they chose the syllable which seemed nearer, 5 chose the left because it was natural to begin to read with the left hand, 2 formed an association at once with one of the syllables, and thus the choice seemed to make itself, 3 said they thought they had made up their minds before they opened their eyes, 2 could not give any reason.

2. Two different letters were shown in the same way. Result: nearness was assigned as a reason in 6 cases, habit of reading in 5. Three new reasons were mentioned,—7 made choice of one letter simply because they had chosen the other before, 5 wrote the one which caught the eye first, 2 chose one because they preferred its form to that of the other, while 9 could give no reason.

3. Next, two circles having the same radius were shown. Result: 9 chose the one which seemed nearer, 7 the left from the habit of reading, 1 no reason.

While the method used in these preliminary experiments was very crude, and the results could not be relied upon as of any scientific value, they seemed to indicate something worth thinking about in forming an hypothesis, *i.e.* The three trials had been made with objects successively simpler, an association was formed only with syllables, and an aesthetic preference was noted only with letters. With letters the motives were less conscious, since 9 were unable to say why they chose one rather than the other; with circles the motives were practically two: "nearness" and habit. Hence, it would seem desirable to plan an experiment in which choice from aesthetic preference should be impossible, and one in which no associations were involved, while the line of investigation indicated seemed to be to measure the force of habit, and to find the meaning of the "feeling of nearness."

The second attempt to find the elements and their proportion is the private history of a campaign that failed, but may be worth mentioning briefly.

Method: A black semi-circular screen was now made, placed on a table covered with black. A black cloth was thrown over the top and a window cut in the middle of the screen. The subject sat in front of this window, with pencil and paper lying on the table. Pairs of gummed letters and figures which had been stuck on white card board were slipped into this window from behind the screen while the subject's eyes were closed. At a given signal he opened his eyes, looked at the window during four beats of the metronome (or four ticks of the watch), and closed them for an instant at another signal, opening them to write one or the other of the letters on the paper. The purpose of this procedure was (1) to find what is the normal proportion of right hand to left hand choices, and (2) what the conscious motives for choosing the right hand or left hand objects are, (3) whether unconsciously the proportion of right to left choices could be influenced by attracting the attention to one side or the other.

Each series of pairs of letters and figures was shown three times, once with something to attract the subject's attention to the right or to the left, *e. g.*, a scrap of red or blue paper, or a person standing on one side or the other, but within the subject's field of vision,—and once without any such stimulus.

Result: (1) without stimulus. The proportion of left hand to right hand choices (118 trials) was, in round numbers, 4 to 7; (2) with the attention attracted to the left hand side by some means, the proportion became 4 to 6 (93 trials); (3) with the stimulus on the right, and another set of subjects, the unexpected ratio of 7 to 4 in favor of the left was found. Upon inquiry it was found that one of the subjects always chose left, and another was never led by anything except associations.

This set of trials was made in the Harvard Laboratory in the winter of '94-5. They seem to indicate a slight influence of attention upon choice when the persons had no fixed habits or permanent associations. A year later, the same experiment was repeated at the laboratory of the University of Chicago, with the assistance of Miss Helen Thompson. The results obtained here were only negative and the experiments seemed to arouse in the subjects the same feeling of annoyance which the child feels when he is told that he may do just as he pleases, but *must* do one of two things, neither of which has any meaning to him. Geometrical forms and kindergarten sewing cards were used, as well as the letters and numbers, but the number of right and left choices was almost exactly the same, and the use of a stimulus seemed to make no difference at all. There are three probable reasons why this method brought no results:

1. The adult cannot choose absolutely unconsciously.
2. So far as he is conscious he is not likely to know certainly what influenced him.
3. The results favorable to the hypothesis that attention is the decisive factor in choice may be due to accident.

Another simple experiment was decided to contain more nearly the elements of natural choice, *i. e.*, a decision which resulted in action involving consequences. Two playing cards were turned faces down, on a bare table at which the subject was seated. He was told to close his eyes while the cards were being placed, open them at a signal and turn one of the cards over. An attempt was made to render the subjects unconscious by telling one class, those in the laboratory, that this was a way of telling fortunes with cards, the observer

making up a story from them as they were turned. Two other classes of subjects were used, (1) adult persons outside the laboratory who were entirely innocent of psychology, and (2) children from the kindergarten. The former class were told that it was a psychological experiment, which, I am sure, conveyed very little information to them, and the children that it was a game which I wished them to come to my house and play with me, I being very fond of children and games.

Result: (1) adults in laboratory, 172 trials; 79 left choices, 93 right, or about a proportion of 5 to 6. (2) adults ignorant of psychology, 178 trials; 87 left, 91 right, or about 12 to 13. (3) children between four and six years. (a) kindergarten sewing cards, 49 trials; 17 left, 31 right, or about 1 to 2; (b) playing cards, 223 choices from 15 children; 54 left, 160 right, or 1 to 3. None of the children were younger than four years, 5 were about six years. The choices of the elder five were: total, 87; left 28, right 59, or about 1 to 2. The choices of the ten about 4 or 5 years were: total, 136; left 26, right 101, or 1 to 4. The children about 6 tend to hesitate and deliberate more than the younger ones, with one exception. One little girl of 4 years always deliberated, and of her 11 choices, 4 were left and 7 right, or the same proportion as the older children.

From these results one is certainly safe in concluding that natural, physical choice, seizes upon the object nearer to the reader's hand. This is seen in both right and left-handed children. The desire for variety is probably indicated by the one-fifth of the younger children's choices of the left hand card.

With these conclusions for a basis, another simple experiment was planned to find the influence of attention upon the normal ratio of right to left hand choices.

1. Cards of two sizes were taken, ladies' and gentlemen's visiting cards, and placed side by side.

Result: (a) larger card to right; 123 trials; left 40, right 83, or 2:1,—the same as the normal ratio. This was tried with 13 children. If we throw out the choices of one boy who said he liked the smaller card better, and of one girl who seemed to have fallen into the habit of choosing the left card, and kept on choosing it automatically, the result stands: total, 114; left 35, right 79, or a slight increase in the proportion of right-hand choices.

(b) Larger card to the left.

Result: left 30, right 69; total, 99.

2. Cards of the same size with a red or blue spot on the right one.

Result: total, 37; left 7, right, 30, or 1:4, double the normal ratio.

3. Cards of the same size with a red or a blue spot on the left-hand card.

Result: total, 130; left 55, right 75, about 1:1½, or a decrease of the normal ratio, but not so much as the additional stimulus on the right is able to increase the normal ratio.

Three children apparently thought only of seeing the other side of the card as soon as possible, seized the card nearer the right hand and were not influenced by the spot.

Not counting their records, the result would stand: total, 161; left 57, right 104, nearly 2:1, or a reversal of the normal ratio.

4. 51 trials were made with cards exactly alike, arranged so: b a

Result: left 30, right 21.

This, so far as it goes, corroborates the conclusion that it is natural to choose the object nearer, when the choice is uninfluenced by any other consideration.

The general results are so simple as hardly to need summarizing, the most important, perhaps, being the extreme complication of the phenomena to be examined.

PSYCHOLOGICAL LITERATURE.

Methodologische Beiträge zu psychophysischen Messungen, auf experimenteller Grundlage. Von A. WRESCHNER. Schriften der Ges. f. psych. Forschung, Heft 11. Leipzig, J. A. Barth, 1898. pp. vi, 238.

This volume contains the record of an elaborate series of experiments with lifted weights, and of minor series with visual distances and temperatures, together with a detailed discussion of results from the point of view of psychophysical methodology. It is with the weight experiments that we are here chiefly concerned.

(1) *Method.* The experiments fall into two main classes. In the first, 15 standard weights were employed, lying between the limits of 200 and 8,000 gr. Each of these was compared with as many variable weights as sufficed to bring out judgments ranging from "much greater" to "much less." The variables differed from their standard by 0,05 P or some multiple of 0,05 P (P = standard weight). An experimental series ("double series") consisted in the comparison of a given standard weight, twice over, with as many variables as were required for certain judgments of the kind just mentioned: the order of presentation of the variables was determined by lot. Each series was taken in a constant time order (P I = standard first, P II = variable first), and was immediately followed by a second series in the reverse order. On the average, 10 smaller and 10 larger variables were used in every series. The method was without knowledge: we return to the point later. The author served as subject in 12,000 experiments of this kind (20 experiments for each of 20 double series with 15 standards). A control group contains 2,400 experiments.

In experiments of the second class, the standard remained constant at 2,000 gr.; the variables were graded as before. The experiments were not confined, however, to a single lifting of each weight. The first weight of the experiment, standard or variable, according to the time order of the series, was lifted once, twice, thrice, four times or five times; then, the second weight lifted once; and then, the judgment of comparison passed. The author has at his disposal, as principal material, 4,000 experiments (800 of each of the 5 groups). Control groups contain 2,000 and 1,600 experiments respectively.

Experiments were also made with varying interval between lift and lift, each weight being lifted once. The standard was constant at 2,000 gr. (pp. 19, 128).

All experiments were performed with a specially constructed apparatus, in which a padded bracelet pulled up a weighted string over rollers. The position of the elbow was kept constant, and the hand (save for its weight) had no influence on the experiment. The judgments classified were "equal," "less," "greater," "much less," "much greater." Intermediate judgments ("equal or less," "equal or greater," "nearly much less," "nearly much greater,") are regarded by the author as good categories, but played a very small part in actual practice. They are counted with each of the chief judgments upon which they border, and these themselves doubled.

(2) *Evaluation of results.* If P is compared with a series of

(smaller and larger) weights, and these differ but little from term to term of the series, we shall get a number of variables that give the judgment "greater," a number that give "less," and a number that give "equal." The number, in each case, represents the "range" of the judgment in question. By determining the upper and lower limits of range—the variable weight which is "still" or "just" judged so or so—we ascertain its relation to the heaviness of the variable weight, its "quality." If the experiments are numerous enough, we find one variable weight which is most effective to call forth a particular judgment: the opposite of the limiting weights, which are least effective. So, with our variable series for abscissæ, and the number of judgments of a given category for ordinates, we obtain a curve of two branches, rising continuously to and falling continuously from the maximal value (*cf.* Gauss's law of error).

These data must be turned to account in as many ways as possible. In the first place, we notice that the curves show the "reliability" of a judgment under varying conditions. The maximal value of the greater curve, *e. g.*, indicates the variable weight with which the greater judgment is most reliable; its limits indicate those with which the judgment is least reliable. Secondly, we can learn something from them about sensible discrimination. It is clear that sensible discrimination may vary with equal degree of reliability: the maximal value may rest on the same number of confirmatory judgments, but these hold of different variable weights. Sensible discrimination is best represented by the central value, *i. e.*, the arithmetical mean of all judgments of a given category. The central value shows what variable weight has the greatest likelihood of calling out the judgment in question. Thirdly, we can ascertain the clearness or distinctness of the division between the various kinds of judgment by comparing the ascending and descending branches of each curve; the branches of the greater curve, *e. g.*, border on "much greater" and on "equal;" those of the equal curve upon "greater" and "less," etc. Lastly, it is well to fractionate the experiments, first into the two sub-groups P I and P II, and secondly into minor groups according to the date of working (variation of disposition from day to day, course of practice, etc.).

(3) *Mutual relation of the three kinds of judgment, "greater," "equal," "less."* Those who have worked with the method of r. and w. cases know that several kinds of judgment are possible. Besides the judgments "greater" and "less" there occur the judgments "equal," "equal or greater," "equal or less," and "doubtful." Doubtful cases must be thrown out; they depend upon lapse of attention, upon disturbance by surprise, upon variation in the impression made by the stimulus during its course, etc., etc.¹ The intermediates we have dealt with under (1). The equals have been a source of dispute. Kraepelin, Jastrow, Fullerton and Cattell, Higier, Löwenton require their subjects to make a guess at difference in every experi-

¹ Fechner halved them, distributing half to the greater, and half to the less judgments. *El. d. Psychophysik*, I, 72; but *cf.* G. E. Müller, *Grundl.*, 40 ff. See also Müller and Schumann, *Pfl. Arch.*, XLV, 40; Wreschner, 12. Some writers would distinguish between the judgment "doubtful" (*i. e.*, either equal or different) and the judgment "different" (with doubt whether greater or less). Küipe ascribes the latter to a "reproduction of the general;" the wider concept of "different" is released more quickly than the narrower concepts "greater," etc. *Outlines*, pp. 68, 73, 172 f., etc. But while we may grant this as a law of reproduction, we do not need it for the "different" judgments in the method of r. and w. cases. Such judgments are probably due to the concurrence of extraneous differences with equality in respect of the attribute under investigation: Meyer, *Zeits.*, XVI, 360. They should, therefore, be thrown out, and the experiment repeated.

ment, so that the judgment of equality is never recorded. Sanford, too, favors the "simpler form" of the method.¹

It is regrettable that difficulties of mathematical treatment should have led to what Ebbinghaus has rightly termed a "Vergewaltigung des Urtheils;" and it is one of the chief merits of the present work, on its methodological side, that it bears out the protest against "simplification" already urged by Merkel, Külpe, Ebbinghaus and Wundt. Dr. Wreschner is able to state definitely, on the basis of the various forms of evaluation given under (2), that "there can be no question but that the judgments 'less,' 'equal,' and 'greater' belong to sharply differentiated (*genau charakterisierte*) judgment categories." His method, which is wider than that of r. and w. cases, allows him to say the same thing of the judgments "much greater" and "much less."

The rest of this section may be summarized as follows: Reliability of judgment is greatest for "less," least for "equal;" sensible discrimination is greatest for "less," least for "greater." Reliability is greater, throughout, in the ascending branch of the curve than it is in the descending; sensible discrimination is greater in the descending branch for "less," in the ascending for "equal" and "greater." "Less" is more clearly distinguished from "equal" than from "much less;" "equal" more clearly from "less" than from "greater;" "greater" more clearly from "equal" than from "much greater." The remainder of the chapter is concerned with the form of the various curves.

(4) *The time error.* The first question to be considered is the question whether the judgments of P II can be reversed ("greater" written as "less," and *vice versa*) to bring them into accord with those of P I. Careful comparison shows that all the characteristics of the two judgment categories, as established under (3), manifest themselves for both time orders, when the reversal of the P II judgments has been made. The psychological reason is that, in the judgments of P II, the memory image of P dominates the subject's mind as soon as P has once been given (second lifting of first experiment)—so that judgments which have the "greater" form are, psychologically, "less" judgments, and *vice versa*. It is always the variable that is judged in relation to the standard, no matter whether standard or variable be given first. Hence any differences between the P I series and the reversed P II series must be put down to the altered time order, and not to differences in the mental mechanism of judgment. We have material for the investigation of the time error.

This analysis is exceedingly important from the point of view of the author's method. Were the subjects told the time order of the first double series or not? Presumably not, since the procedure at large was procedure without knowledge. Suppose, then, that the morning's work begins: chance decides what variables shall be given in the first few experiments. How is the subject to know his standard? There must be a number of initial experiments, varying as the occurrence of mean or extreme variables varies, during which the identification of the standard is impossible. The assumption that these judgments belong to the P I order (in a P I series), and their reversal from the P II to the P I order (in a P II series), cannot be justified. Of course, the knot is cut, if the subjects were acquainted with the time order in every case; but this is nowhere stated.

In either event, a more general criticism may be passed. Is "absolute" judgment in the P II series—judgment of the weight first given in terms of a memory of P, and confirmation by the appearance

¹ Course, pp. 353 ff.

in perception of P itself—is absolute judgment of this kind, which is regarded as a bad experimental habit in the method of r. and w. cases, a form of judgment which it is worth while to introduce in weight experiments by any method? The matter cannot be discussed in detail here. We may, however, note that the part played by the memory image in these experiments must of necessity dispose the author to that psychological theory of the time error which he later adopts.

The results of the chapter are summarized under six heads as follows: 1. The time error has a twofold character; it may be positive (first weight heavier) or negative (second heavier). *a.* Granted a certain degree of practice, it is of greater negative (or lesser positive) value for the smaller variable weights than for the larger: without practice the reverse obtains. *b.* It is positive with the smaller, negative with the larger standard weights. *c.* Continuance of practice changes it (especially with the larger variable weights) in the positive direction. *d.* Fatigue changes it (especially with the larger variables) in the negative direction. *e.* Increase in the distinctness of the memory image of the first lifting changes it in the positive direction. *f.* Within certain limits, increase of time interval between liftings changes it in the negative direction. 2. The magnitude of the time error is variable. *a.* With all variable weights, it is larger, the more remote the variable from the limits and maximum of the judgments "greater" and "less." *b.* Practice reduces it. *c.* Granted a certain degree of practice, the smaller variables have a larger time error than the larger: without practice the reverse obtains, as it does also under all conditions with small standards. *d.* The time error is smallest with moderate, greatest with very heavy, and moderate with small standards. *e.* In experiments on visual distances and temperatures, the negative value of the time error is less when the standard stimulus is on the left hand side. 3. Sensible discrimination is greater for P II than for P I; "less" is the only exception to the rule. 4. Reliability of judgment is greater for P II than for P I; "less" is, again, the only exception. 5. The time error obtains in very various sense departments (sight, hearing, temperature sense, "muscle" sense). 6. It appears in the two-handed as well as in the single-handed procedure.

It has already been said that the author adopts the psychological (memory image) theory of the time error, as contradistinguished from the physiological (after-effect of first stimulus). He does not, however, deny that fatigue, etc., may have something to say in the matter. The twofold character of the error he explains by the generalizing and schematising tendency of memory, as compared with perception; we have a positive error, a negative error, or no error, according to circumstances.

(5) *Practice.* The theory of practice is considered under the three heads of apprehension of the two weights, estimation of their relation to each other, and retention of the first impression in memory. It is noteworthy, in the latter connection, that the weight first raised appears heavier to the practised than to the unpractised subject: especially is this the case when the variable weight is lifted before the standard. The blurring, weakening effect of memory is thus compensated (pp. 208, 211).

(6) *Weight of the standards.* As was to be expected in an investigation of this kind, there is no direct and unimpeachable evidence of the validity of Weber's law. With constant relative difference between stimuli, it was found that reliability of judgment, sensible discrimination, and separation of the judgment categories improved with increase of absolute weight (limits 200 and 8,000 gr.). On the other hand, the effects of practice and of the time error must not be forgot-

ten; and the author's conclusions square pretty well with those drawn by Fechner (*Elem.*, I, 199) and Müller (*Grdl.*, 225).

Dr. Wreschner may be heartily congratulated on the accomplishment of so thorough and comprehensive a piece of work. The criticisms passed above must be taken as suggestions only; the true test of an experimental enquiry lies in its fruitfulness for further research, and its stability in face of new results.

E. B. TITCHENER.

Etudes d'Histoire de la Philosophie, par E. BOUTROUX. Alcan, 1897.

The first chapter of Mr. Boutroux's "Etudes" treats of the conception of History of Philosophy. He does not think that the philosopher as a man ought to be dealt with; nor does he consider the study of special treatises on some topic or other, the object of History of Philosophy. Only in case we find in the writings of a thinker the elements necessary to truly constitute a system of philosophy, need we consider him as forming a part of History of Philosophy.

Two essays, the one on Aristoteles, the other on Kant, are reprinted from the *Grande Encyclopédie*. They bear the mark of such works; they are destined to be read by the public in general, and they therefore contain only the absolutely necessary amount of philosophy; they are of no interest to the specialist.

The study on Boehme is entirely different. With the skill and clearness particular to French thinkers, Boutroux is most successful in extricating the rational element of the thought of Boehme, from the mystical form in which it is enveloped, and he succeeds in presenting a thorough and systematic statement of this philosophy, which is no easy matter. The author points out that the speculations of Boehme are very nearly the same as those of the later German metaphysicians—Leibnitz, Kant, Fichte, Schelling, Hegel, Baader, etc., although he presents them in a different form; and the former fact explains the name of *philosophus tentonicus*, which his friend Dr. Walther justly gives to Boehme. Upon reading Boutroux's work, one has the impression of encountering solid reasoning. And yet it seems to me that he is not entirely right. For not only does one meet with the speculations of Boehme in the works of German metaphysicians, as Boutroux says, but also with metaphysicians of all times and of all countries.

There are but few metaphysical interpretations of the world. They are generally ranged in three classes: pantheism, theism and materialism; and each kind of pantheism has only very few features differing from some other kind of pantheism, just as every kind of theism is akin to other theisms, and one materialism is akin to other materialisms.

Considered in this light, the argument of Boutroux loses a great deal of its value. The only outcome of his reasoning is, that, if the metaphysical speculations of Boehme seem more like those of German thinkers than of thinkers of other countries, it is because German thinkers are more apt than others to devote themselves to metaphysical speculations.

It often happens—and such seems to be the case here—that, in studying the works of a man, we gradually become fascinated by him and consider him more important than he really deserves. This is an error of which Boutroux became guilty, both in treating Boehme and in his examination of the influence of Scotch philosophers on French thought. It cannot be denied that this influence exists; Reid, Dugald Stewart, Brown were thinkers of the same stamp as

Royer, Collard, Cousin and Jouffroy. But, in reading Boutroux, one would have to believe that in the XIX century, very few, except the Scotch and Eclectic philosophers have had any influence. Boutroux preserves a most astonishing silence as to German, and especially Kautian, influence. It may be said that this does not pertain to his subject. Be it. But Boutroux has attributed so much in French philosophy to Scotch influence, that if he were now to write an essay upon German influence on French philosophy, he would find that he has left none to assign to the philosophers of that country. Not only does Boutroux completely ignore Kant, but he goes so far as to make Hamilton a pupil of Reid; and, what is worse than all else, he claims that Reouvier, the head of the New Kantian School in France, is a follower in philosophy of Hamilton.

Another striking example of the method of our author is this: According to Boutroux, A. Comte is a production of the Scotch School, because he considered Hume his most important precursor. How could a man like Boutroux apparently forget that the part of Hume's philosophy adopted by Comte, was exactly that part of his doctrine against which the School of Reid fought with might and main?

Finally, a few words on the essay on Socrates. It is the best thing ever written on this philosopher that I know of. The author discusses the opinions of prominent thinkers on Socrates, especially Schleiermacher, Zeller, Grote, Fonillée.

The most important theses attributed to Socrates by Boutroux are as follows: The object of his thinking is True Happiness in opposition to apparent bliss. He finds this happiness in virtue. The art of doing right has to combine itself with, or rather is based upon, the science of doing right. To attain this end, all science must be concentrated in ethics. Physics and metaphysics are treated by him only for the sake of ethics. Socrates's great merit consists in having established a science of ethics.

The basis of science—which our author considers synonymous with ethics—is the "General." This word, we are to understand, means: What everybody thinks, what is the common fund of thinking of all men. There must exist something of this kind, since men can understand one another by means of language. In order to find out what this "General" is, one must speak with ordinary men, which, as we know, Socrates did. His method of teaching was the dialogue.

The result of his researches in the domain of science of ethics, is: Self-control is the greatest virtue. Socrates is not the good-natured man we often believe him to be; his actions seem to spring from a source of goodness, but his end was only his own perfection, not the relief of the suffering of others. His main object is to discipline himself.

See especially pages 83-84, too long to quote here.

ALBERT SCHINZ.

Scipio Sighele. Psychologie des Sectes. Traduction de L. BRANDIN. Paris, Girard & Brière, 1898. Bibliothèque de Sociologie Internationale.

Introduction. With the progress of civilization, crime has changed its character. With savage peoples it was gross and brutal; it has now grown more and more crafty and refined, it has become intellectual. This is not only the case with individual crime, but also with collective crime. The author claims the honor of having introduced the study of two kinds of crime in regard to collective bodies, such as crowds, sects, classes, etc.

Chapter I. There are different kinds of crowds, ranging from the heterogeneous crowd to the organized State, which is the supreme and most perfect form of homogeneous crowds, reached by the intermediate stages of theater or concert goers, clubs, jurors, parliaments, sects, castes and classes. The prominent feature of the *sect* is that they have some faith, religious or politic, in common, that of the *caste* is a common profession, and that of the *class* common interests.¹

Chapter II. The individual is always influenced by the circle which surrounds him. The member of a sect is influenced by an idea in which he believes. The sect becomes a party when the idea has gained a sufficient number of partisans. The difference between a sect and a simple crowd is, that a crowd uses only violence to attain its ends, while a sect employs craft. A sect always has a leader (*meneur*), which leader, however, is led (*mené*) in his turn by the idea he fights for.

Chapter III. There are different kinds of morality, individual and social, the morality of family, of country, etc. Among others also the morality of sects and politics. All of them are either morality of love or of hatred, and have their origin in the instinct of preservation.

Chapter IV. Man as an individual is far more moral than man as a social being. The long discussion upon the legitimacy of a morality of hatred, which the social man holds, remains without result. On page 174 the author says: "Everybody admits that ideal politics would mean honest politics. But could such politics be ingenious (*génial*) at the same time, and thus useful and fertile? Can you imagine a diplomacy which would be great without lies? A government which would be strong but void of despotism? A sect succeeding without violence of some kind? Neither in the past nor in the present do we find such examples. As for the future it seems doubtful."

One sees to what solution the author inclines; however he appears to be afraid to confess it here. But the "Introduction" clearly signifies a negative solution, since there he positively asserts that civilization is based upon two kinds of crime, one using cunning, and the other employing violence.

In the Appendix: "*Against Parliamentarism*," Sighele points out that, even if the members of a parliament are the best men of a country, the result of such a government would be most unsatisfactory. This he bases upon the (rather doubtful) argument of Max Nordau, in the second chapter of his "Paradoxes": "One may say that all men in a normal condition possess certain qualities which constitute a common value, identical, equal, we will say to *x*. Superior individuals possess an additional value; but this time it is of a different kind with each one; it must consequently be indicated in a different way in each case; we will say, for instance, that it is equal to *b*, *c*, *d*, etc. It follows, that, out of an assembly of twenty men, all of whom are geniuses of the highest order, there will be twenty *x*'s, but only one *b*, one *c*, one *d*, etc., and the twenty *x*'s will naturally outweigh the isolated *b*, *c*, *d*; in other words, the "general" in human nature will outweigh the individual personality, and the cap of the working-man will eclipse the hat of the physician, of the thinker, and of the philosopher. "Parliamentarism is the system of making laws by a majority, which majority represents the common level of the intelligence of a nation. Now, if the majority is to be considered as being right, then all progress may be looked upon as an impossibility.

These are the ideas exposed and upheld in the book. They are

¹This classification is taken from Le Bon.

neither original, nor numerous, nor very deep. I do not see well why R. Worms has considered this work worthy of being translated and introduced into the "Bibliothèque Sociologique Internationale." 1. As for the lack of originality, it is necessary only to read Chapter III, where the old and well-known differences of views in the ethical judgment of a single man is as broadly exposed as if nobody had ever pointed it out before, or as if it were necessary to explain at length to a philosopher, that the deed of Charlotte Corday cannot be judged in the same way as an ordinary crime. 2. The scarcity of ideas becomes apparent by this summary. 3. I said that the book is not deep. As an example of this, the fact may serve, that Sighele thinks it necessary to demonstrate that the leader of a homogeneous association only exerts his influence upon members of his association, while the leader of a heterogeneous association, or a crowd, exerts his influence upon a less defined class of people (pp. 79-80). It must be added, that the author repeats himself so often, that it is tiresome to read him. An idea which would be amply treated in a single sentence is met with again and again. (See, for instance, p. 46 the difference between a *sect* and a *crowd*.)

Mr. Sighele, as Mr. Le Bon in France, has made a specialty of the study of the psychology of crowds. In a very high tone he claims for himself priority over Le Bon, and considers it wise to take up his polemic again in this book (p. 42). But putting aside the question of priority, I am sure that many will agree with me, that the "Psychologie des Foules," by Le Bon, is of far greater value than Sighele's works; Le Bon is truly a scientist, while Sighele is only an enthusiastic writer who dwells upon some few ideas with great volubility.

ALBERT SCHINZ.

Psychologie du Peuple Français, par ALFRED FOUILLEE. (Bibliothèque de Philosophie Contemporaine. F. Alcan, Paris, 1898. pp. 388.)

Mr. Fouillée has added a new volume to his collection of books developing his favorite thesis of "*Idées-Fortes*." His theory is plainly seen throughout the volume. Nationality should not be considered from a purely physiological, ethnological, or economical standpoint; above all it manifests itself in psychological characteristics: language, religion, poetry and art. Of late years too much importance has been attributed to physical causes, and the reaction of the intelligence and the will against the milieu has been too much neglected: "Men, and especially groups of the human society, adapt the milieu to themselves with as much facility as they adapt themselves to the milieu." (P. 56.) Owing to the intelligence of man, history of humanity cannot be reduced to natural history: "The milieu modifies the animal, but man modifies the milieu." (P. 56.) Book I is devoted to determining what races have united to form the French nation.

In Book II the character of the Gauls is described, and in Book III that of the present French nation. The resemblance between the two is striking. There is hardly a single feature of the Gauls, such as ancient writers mention, which is not again found in the modern inhabitants of France,—and one doubts, after all, whether the influence of the milieu, already noticed by Strabo, is not of greater importance than the authors seem to admit.

Book IV is entitled "Degeneration or Crisis?" Mr. Fouillée admits that France has come to a crisis; but contrary to many ethnologists of to-day, he does not admit any degeneration. There is no doubt that the nation is greatly attacked, but it is, as yet, not so weak as to

be unable to recuperate. Any delay, however, may have fatal consequences, and already the French are to blame for their negligence in finding remedies for the evils. The chapters on Alcoholism and on Depopulation are especially interesting.

In conclusion, I should like to say that, in reading his book, we must not forget that the author is French, and very fond of his country,—which accounts for his often too enthusiastic judgments. For instance, it seems strange that, from the Celts, from the Germans and from the Mediterraneans, the French adopted only the good qualities without ever being affected by the Cadones. The chapter on music will surprise every impartial reader, and expressions like "*Our Alsace-Lorraine*" are out of place in a scientific work.

ALBERT SCHINZ.

La Philosophie de Nietzsche, par H. LICHTENBERGER. Paris, Alcan, 1898. 182 pages.

There is hardly another thinker so difficult to truly understand, as is Nietzsche. His books are not, in our sense of the term, systematically written. His style is brilliant, but not always easy to grasp. Not one of his works contains the whole thought of the author. There is a great number of them (12 volumes published so far). Again, Nietzsche changed his views more than once, and one very often encounters contradictions in his writings. It is due to all this, for a great part at least, that the European critics totally misunderstood Nietzsche. A book like that of Mr. Lichtenberger would have prevented many unjust judgments. Nietzsche is now being studied in this country. I should be glad to see the little book I speak of, serve as an introduction into the study of Nietzsche. If he will be found as interesting in this country as he was regarded in Europe, nothing could be more useful than a translation of Lichtenberger's work.

The origin of Nietzsche's ideas is very clearly exposed. Also, the transition from one period of thought to another. The rational ground of the dry and often hard and repelling paradoxes of Nietzsche, is especially well developed. As a rule, only short and startling maxims are attributed to Nietzsche. Isolated, away from their context, they not only sound strange, but seem to be the production of a mad mind. On the other hand, to read Nietzsche is, as I said before, a wearisome undertaking, or, rather, a difficult one. On reading the 182 pages of Lichtenberger's book, one will be able to see every one of these well-known quotations in their proper light, and one will no longer think only of attacking Nietzsche, but of reflecting upon the many problems he has treated in such an admirably original way.

I cannot but call attention to another merit of Lichtenberger's work. Nietzsche is exceedingly suggestive. It is therefore a very strong temptation for any one writing about him, to discuss him only, and not to explain and expose his ideas. Lichtenberger succeeded in putting Nietzsche forward and in keeping himself in the background.

ALBERT SCHINZ.

L'Art et le Réel. Essai de métaphysique fondée sur l'esthétique par JEAN PERES. Paris, Alcan, 1898. 200 pages.

A listless after-stir of the great wave of transcendental idealism, to which a grain of theism is added; a feeble and indistinct echo of the aestheticism of Kant, of Schelling, and here and there of Hegel, modified by a Leibnitzian touch—that is all that can be said of the vague and indefinite work of Mr. Jean Pérès.

ALBERT SCHINZ.

CORRESPONDENCE.

The following letter was written with no thought whatever, on the part of Professor Garman, that it would ever be published. It was in answer to a personal letter which I addressed to the author requesting information for my own use. His experience and rare success in teaching philosophy, and the value that I myself derived from it, has prompted me to request him to permit me to print it for the benefit of others—which he has very kindly consented to allow me to do. It appears exactly as it was written, with no revision whatever.

G. STANLEY HALL,

Clark University, July 23-98.

AMHERST, MASS.

My Dear President Hall:

The problems that you propose in your letter of Feb. 8 interest me greatly, and I am very glad to have an opportunity to state to you my experience. It is a matter I have puzzled over much for the last eighteen years, and I am very far from feeling that the problem is solved yet. I have constantly altered my course and tried new experiments, but still the undergraduate is an uncertain quantity, and methods which secure a phenomenal success with one class meet with much resistance from others.

First, a word as to my methods of work. There seems to be an unavoidable resistance to new ideas on the part of students at this age, a resistance that during the last few years has increased. I have gradually settled down to the conviction that an introductory course ought to be so arranged as to meet this resistance most advantageously. This I have secured by two devices: first, the pamphlet system which I think is as much of an invention as printing by movable type. These pamphlets I have printed at my own expense; they are very fragmentary, taking up a single topic or part of a topic and treating it as one would in a lecture; these I loan to the students, and they return them for the use of the next class. In this way I can state a question without answering it by having them turn over to the next chapter of the book and find the answer given there. If I find the question is really appreciated, the effort is a success; if not, I must approach it from some other direction, by some other pamphlet which shall have enough new material to hold their thought and stimulate their inquiry, and yet, at the same time, focus their attention on the problem they have failed to appreciate. In this way I can keep the class at work and keep them moving, prevent their being taken up with outside occupations and amusements, and at the same time be reviewing more thoroughly work they have partially done. It requires as much skill to keep a class together in the introductory course, to give enough work for the best students and not too much for the less able as it does for the police to handle a large crowd at the time of a public celebration. I can do it with pamphlets, I cannot do it without. If I read lectures before the class to any extent they become spectators, but by means of the pamphlets they get the lecture before coming into the class room, and our time is spent in discussion.

My second device is the order in which our subjects are taken up. Years ago when I taught geometry I found that the students would often times make it a mere intellectual puzzle or mental gymnastics, but that by applying some of the problems to questions in surveying, in astronomy and physics, I could bring the men to realize that in studying geometry they were gaining citizenship in the universe, and they were at once led to interpret their lives as far as possible in terms of these propositions. In taking up philosophy I have attempted to do something of that same kind of work, I present the fundamental positions from the point of view of the history of the discussions in psychology, in philosophy and ethics, and to some extent of political obligations. It makes the matter as serious and personal as possible, and as a result it has often cost the students a very great effort to satisfy themselves instead of simply meet the requirements of the recitation room.

Now in answer to your particular questions I can only give very general impressions.

"1. Why is this (readjusting of their views) necessary, that is, what is it meant to accomplish?"—The earlier life of the students has been one of imitation and obedience to authority; it corresponds to traditionalism in tribal or national existence. The great requisite for a young person is to form habits. I have sometimes been asked to give lectures to the lower classmen on methods of work, and I think it would be very proper to do so, but I have more and more realized that students acquire right methods of work not through explanation but through imitation and discipline. I have had students completely carried away by my lectures on methods of work in the fall term, and declare that "if they had only known that freshman year it would have made such a difference with them," and yet in three months' time the entire effect had passed away, and they would do only what I forced them to do by actual drill. I am confident, therefore, that the earlier education of the student must be wholly by imitation, which should be more or less blind. But there comes a time when the young man must assume responsibility for what he does; there must be self-possession and self-direction instead of dependence on authority, and this is a new experience to him, an experience which many shrink from even in very little things.

Those who decline to follow this unfolding of their nature, and there are very many of them, begin to fossilize. If they are religious they soon become Pharisaical, get lost in particulars, are unable to discriminate the essential from the accidental, and take refuge in doing something, and their religious activity is often times such as exhibits zeal, but without knowledge. If they are not religious they become fastidious in imitating social customs, and very soon develop a degree of indifference towards everything except mere form; they become heartless, selfish, many cynical. There is no hope for a young man at this time if he does not meet the obligations of life with the spirit of self-reliance, but to do this he must have some confidence in his own judgment and the standards by which he judges. This is the spirit of philosophy.

A young man who does not have the spirit of philosophy grows up a woman minus her virtues, he can never have the intuitive power of a woman, but he is sure to have her sensitiveness, her vanity, her fickleness, and generally he will greatly exaggerate these qualities.

It is my conviction that a young man can obtain inspiration, enthusiasm, absence of self-consciousness only by the steady contemplation of great truths; that if he is wholly absorbed in imitation, he is like a person whose whole work is that of a proof reader; if he is

successful, he is taken as a matter of course, and he gets no credit; if he is unsuccessful and makes mistakes he is awkward, he is ridiculed beyond endurance; he soon realizes that the most promising rewards for the most careful efforts are negative, and he soon becomes indifferent, and is simply goaded on from fear of the consequences of failure. But the young man who philosophizes, who really understands himself and appreciates the truth is no longer a slave of form, but is filled with admiration that is genuine and lasting.

This, I believe, is exactly the issue which is settled at this critical period of a young man's life. But the question arises why should philosophy, psychology, and ethics be the studies which most favor self-reliance rather than mathematics or the sciences.

I have often raised the question as to whether I would not let down my course and take a little rest and devote myself to publishing, but I have found that somehow students' minds would be satisfied with nothing less than these most difficult problems. I did not awaken enthusiasm or gratitude until these were mastered, and so I have come to the conclusion that there is something in these subjects which the mind demands at this stage of the young man's development.

It seems to me that mathematics fails to meet the demand for two reasons; first, there is no difference of opinion on all these subjects, and the student does not really have to stand on his own feet; thus it may become more a discipline in ingenuity than in decision, self-reliance. Secondly; he often times knows pretty nearly what the answer will be, and therefore gets very decided hints as to the means, that is, he really has some guidance either from text books or from experience; he is not a Columbus sailing over unknown seas with everything before him untried.

With regard to the physical sciences; there is some difference of opinion here, but his main time is spent in undergraduate work on matters that are generally accepted; he has more or less assistance about the use of the apparatus, and his main consciousness of need is of ingenuity and of quickness, and then the enormous admiration which our age has for the discoveries of physical science give him almost a superstitious reverence for anything that can be called scientific. I mean by that that he accepts a great many positions in science without really testing them, and thus he almost gets back into the imitative work again; but when he comes to philosophy it is a new world, the trend of public opinion, especially of society life with which he is most familiar, is not in that direction; it requires something like the heroism which was demanded of Luther, and of the anti-slavery leaders for him to attempt the positions which even in an undergraduate study are forced upon his attention, and he cannot follow authority, there is so much difference of opinion. He is obliged, therefore, to weigh evidence and to let himself down with all his weight upon his own feet. It takes me six months to bring even the better men in the class up to a place where they will really weigh evidence; when their attention is called to it, the issue is forced and they are greatly surprised to find the extent to which they have blindly followed authority, they are almost as frightened as some horses are when the blinders are taken off. But when the idea fairly dawns upon them that true scholarship consists not in some mystical quality of genius which ordinary men do not possess, but in simple honesty to one's self in following out the Cartesian Golden Rule, then they experience a new birth, they are no longer boys or slaves, but men. If they attain citizenship in the kingdom of truth they perceive that the difference between the greatest and the smallest consists only in the quickness and comprehensiveness and thoroughness and humility of

their work. Truth to one man is truth to all if they can get exactly the same data and exactly the same standards. Henceforth, they call no man master or lord for all are brethren.

No doubt a similar development could be secured, if we could only have the right circumstances, by business responsibility, or military service, or by actual professional practice and training, but I think it would be pretty costly, and that the usual percentage of failures would be maintained. Philosophy has this advantage, that it gives the training under such circumstances that the best results can be secured with the least danger.

"2. How should it be guided, directed or controlled by the instructor, *i. e.*, what topics first and last; should it be deep going or drastic; are there dangers, and if so, how avoided?"—The first requisite is success. Power reveals itself only in work done; if the student gets confused and discouraged he is worse off than if he had not attempted to decide for himself.

It is my conviction that the introductory course should always be given by a teacher of the largest experience and greatest power of adaptation. I feel that when the student has learned to stand on his own feet and to weigh evidence thoroughly, and to avoid jumping at conclusions because they appear plausible, that he can be left to the guidance of the less experienced teacher, but that first acquaintance with philosophy is the grand opportunity, just like the breaking of a colt; carelessness here will vaccinate against future success.

The student needs to be taught first constructive thinking; he has been accustomed to a certain amount of analysis. All this, with rare exceptions, is clerical work. He will make a very good table of contents or the outline of a certain argument, but he takes the author's own estimate of each step of his position, and has no power to understand independent valuation. The first thing is to teach him that scholarship demands constructive criticism, and here we must begin with the easier subjects. In my own experience hypnotism is peculiarly favorable for this kind of work. I give them several recitations on the details of hypnotism up through double consciousness in Binet, etc., then I ask them to give me not an outline or table of contents, but such an argument as a judge would give when reviewing the case before a jury, telling them not to go into details, and not to jump at conclusions, and to give the extremes under each type. The papers I get back are a sight to behold. These I criticise, writing in corrections with red ink, and hand back, and then require them to try again. By this time they discover their mistake, but do not see how to remedy it, and then comes a great deal of very frank talk. Then they realize for the first time how much they are guided by authority and imitation and indeed begin to wonder if there is anything else in scholarship. Then I give them in very brief form my own argument, and then follows a most interesting series of comments which generally agree in this particular: "how could we be expected to have discovered anything like that in the reference-books?" and it very soon becomes formulated into the idea that the standards for undergraduate thinking ought not to be the same as that which is demanded of the teacher. In other words, there is a difference of kind between the teacher and the taught.

I believe the great secret is to take some one subject and make a success of that rather than to go from subject to subject. Hence, I work over this particular problem until the men come to see clearly that it is simply an unfolding process, and that they could have worked it out if they had only weighed evidence. We then take up a series of subjects in psychology, and show their ethical and practical

significance, and also the places which they have occupied in historical discussion. Each subject has a two-fold significance; first, it is not so difficult but that the students can, in time, realize just what constructive work here means. Secondly, each subject points in a particular direction, namely, towards the unity of our mental life, the fact that our practical activity is founded on our mental constitution: and the students are brought to realize that simple things are more complex than they seem, and therefore more thorough study will be demanded, purely from practical considerations if one has no higher motive. I feel that the work should be thorough or not touched at all. Some subjects may be merely referred to, but it is better to take one subject and do it thoroughly, and show the students what it involves, and the true methods, than give the results of investigation without giving the processes.

Just here I have to fight strenuously against the students using the class room as a pony; when a problem is given out and the data presented in the class room, they must attempt the solution for themselves, and not wait and get the results presented in the class room. Hence, I require frequent papers written on topics by the whole class before the discussion is completed in the recitation. By means of the pamphlets I am able to do this, but if the pamphlets were bound up in a volume the students would look over into the next chapter and save themselves trouble. The dangers that are most serious, in my judgment, are demoralization and discouragement, such as may come over an army in a panic. Students are very quick to suspect a sleight-at-hand performance on the part of the teacher, and that some other author could get just the opposite results, and instead of weighing evidence they fall back on ingenuity and sophistry. I believe every student has to go through a period of sophistry if he fairly faces this work, and I believe in having this fit of measles early and have it out of the way, but for some little time the teacher has got to be on the lookout for the sequelæ, and he must not trust too implicitly to students when they say they are through with them. They are quite likely to enjoy the position of uncertainty, and use it to justify themselves if they have any immoral tendencies, but if you can get the man so far along as to make him have confidence in the power of weighing evidence, to realize how much civilization owes to it, how every department of life can be progressive only through scientific thinking, and then make it a moral question, and show that intellectual honesty and supreme choice of truth for truth's sake, and determination to follow evidence to the best of one's ability, is the great line of cleavage between the saints and the sinners; if you can force the issue here and win, then the class are entirely different afterwards. I do not believe without this moral battle, without considering the ethical phases of the question, it would be possible to get the best intellectual results.

3. "What would be one or two good literary treatments of this question of epistemology, *i. e.*, is a course in Locke, Berkeley and Hume the best to begin with and is Kant a final solution?"

Having taken them through a discussion of some of the simpler questions in psychology, our work centers around the doctrine of association and habit as is presented by James, and the men are made to realize how much of our life has a physical basis, especially by the study of pathological cases. We now face the problem: is it all dependent on brain action? If so, what would be the consequences? Up to this point they have had the point of view of physics and the natural sciences. Epistemological work is fairly before us when we take up Berkeley. I should prefer Berkeley and the Sophists taken

up together. The great thing is to force upon a young man's mind a problem in all its seriousness. I do not feel that Locke is an economy of time for an introductory course unless some of the men hold to innate ideas. Therefore we begin with Berkeley, then take Hume with John Stuart Mill's additions, then selections from Spencer until we get before the student the problem of our standards of thought, whether these might not be wholly relative or due to association, and show what would be the effect on ethics and religion. Then we take up the study of reflex action, the automaton theory, and psychological problems. This brings the matter home to the students, till it seems as though physical habit (heredity and associations of ideas) would account for our most sacred convictions. The reason why I make this so strong is because at present there are very many outside enterprises distracting the students' attention. Unless philosophy is a life and death matter you will not get the thorough work, the hard work which the students really need to do. He soon gets a faith in the teacher, and that a man who is able to present so clearly the argument on a few points which they have had will be able to guide them on all the difficult ones, and that somehow they will come out right anyway. So when they get into the larger questions and do not see the bearing of some of the problems, they are in danger of making drudgery out of it instead of philosophy and so lose their inspiration.

Our next step is then to bring before them the questions: can the brain weigh evidence? Can the brain give us personal identity? Can the brain give us memory in the true sense of that word? Can we account for the existence of error if we have only brain action? Here we take up such discussions as are given in Clifford and James's "mind stuff," and review Herbert Spencer until the men clearly realize the position which Wundt brings out, that there must be such a thing as psychical causality. This comes to them like a revelation. We are then ready for Kant and at the same time for the study of particular questions in physiological psychology. Then the men see what the fusion of sense perceptions means, also what problems are at issue in space perception, for instance, or in time perceptions, and most of all in attention and volition. It does not seem to me that the main problems of experimental psychology should come at the beginning of the course; they surely get a double meaning when taken up at this stage.

4. "Is it possible to find the way out of agnosticism or could an ingenuous soul be left to wrestle with it?"

My feeling is if the best students have the right method of work and have the spirit of investigation, agnosticism would in time work itself out if left unsolved, but that the average student needs help, at least to this extent to show him that he cannot make any hypothesis which will be a reasonable basis for his knowledge of the physical world and of natural science that does not involve as its basis something more than the physical world. I believe the place to take this up is with Kant's Practical Reason, and if this is fully appreciated the students will find no great difficulty in theism, at least as the only hypothesis which gives any basis for science and human life. It is so easy for them to feel that our knowledge of the material world is simple, and our knowledge of moral obligation and of spiritual life a mere matter of opinion that I cannot content myself with leaving the class until they realize just the reverse. It is not very hard to make the students understand that our standards of thinking are spiritual, and that unless we can use these standards in judging others, and in interpreting nature, and in interpreting human life and human destiny we are guilty of the worst form of anthropom-

orphism, an anthropomorphism for which there is not the slightest justification. But with the application of these standards moral obligations are authoritative and society cannot dispense with them. The class derive great inspiration from this point of view. It converts them from disciples to apostles, and it helps them in every position of graduate work, in law, in literature, in theology, and in medicine. The business world is the severest trial, and yet nowhere do they need this point of view so much as when they are tempted to sacrifice everything to mere accumulation of wealth.

The great need of our students from a practical point of view is an ideal; the great danger is that they will become visionary. Hence, I cannot let them go until I hold out before them the ideals of a spiritual life, and then make such a practical application as will enable them to understand the evolution of religion, that is, how it was possible for a divine being to tolerate slavery, polygamy, etc., provided these are wrong. I show them that an ideal is like the north star which the colored slave would follow, not with the expectation of ever reaching the star but under the hope that by following it he might better his condition. I bring in the laws of unfolding of the life of the individual and of the community, until the men discover that the great question of human history is not so much "where we are as whether we are drifting," and that time is required for all progress. Without this discussion the men would at first be idealists and visionary and then get discouraged and wonder whether their college course had not been too optimistic, and whether finite human beings are not powerless to hasten the evolution of the race. This will lead to hope and lessen their indifference as citizens.

I fear I have wearied you by my long letter. I do feel that the teaching of philosophy is an opportunity which no other study offers. I feel that the student who has been through these doubts and worked them out for himself has learned the strength and at the same time the limitations of the finite, and that he will have a degree of courage and patience in adversity, a degree of self reliance and humility which others can secure only by those peculiar experiences which occasionally occur in actual business or politics, or the professional life. The student who has taken philosophy realizes how the part is to be estimated in the light of the whole, he realizes this more completely than he could from any other study. He also realizes the dignity which a part may secure from the grandeur of the whole to which it belongs, and that the little things in life have a depth of meaning for him which they could not have if he had not this point of view. There are considerably many who, in spite of all the teacher can do, use the class room as a pony, who, therefore, get only some of the benefits of the course, but it shows in all their other work. The habits that are formed in college are so persistent that the student does not readily change them after he goes out.

Hoping that I have not tired you by my long account, and that I have not given too much emphasis to the personal equation, I am

Most sincerely yours,

CHARLES E. GARMAN.

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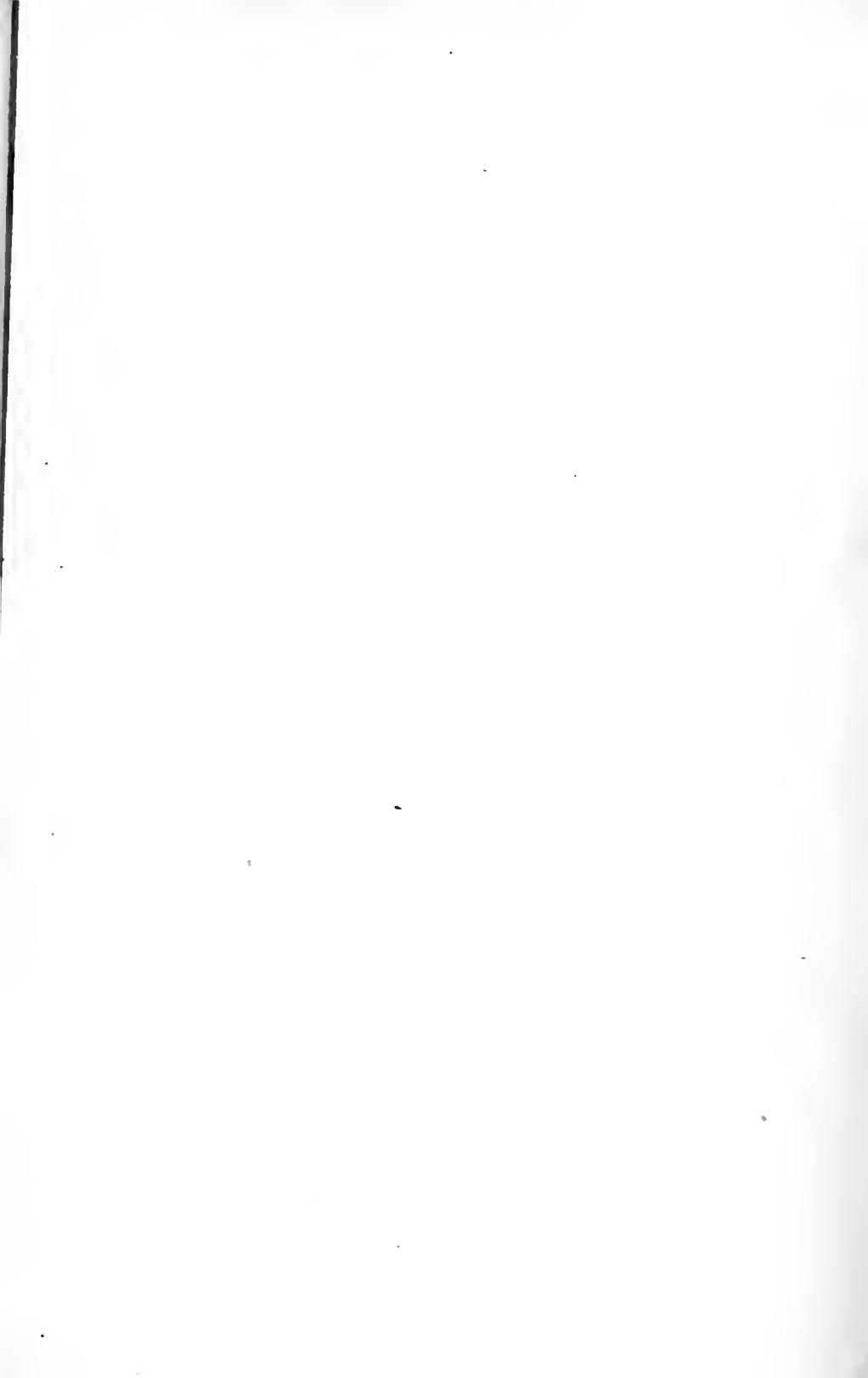
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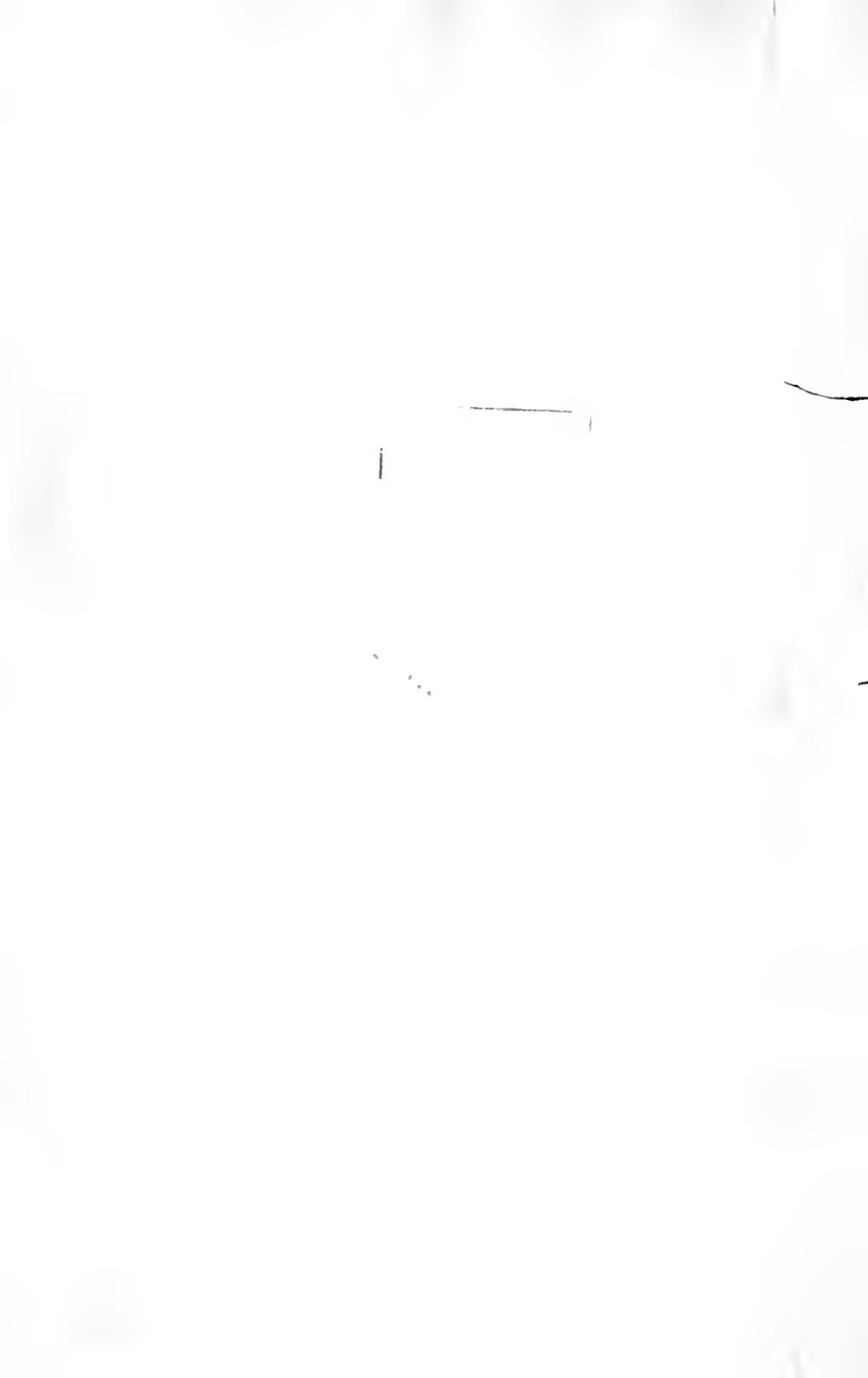
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